Chemical Engineering

MAY 1954

WE MODERNIZE –

Or Else!

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Operations Research

WHAT'S IN IT FOR YOU

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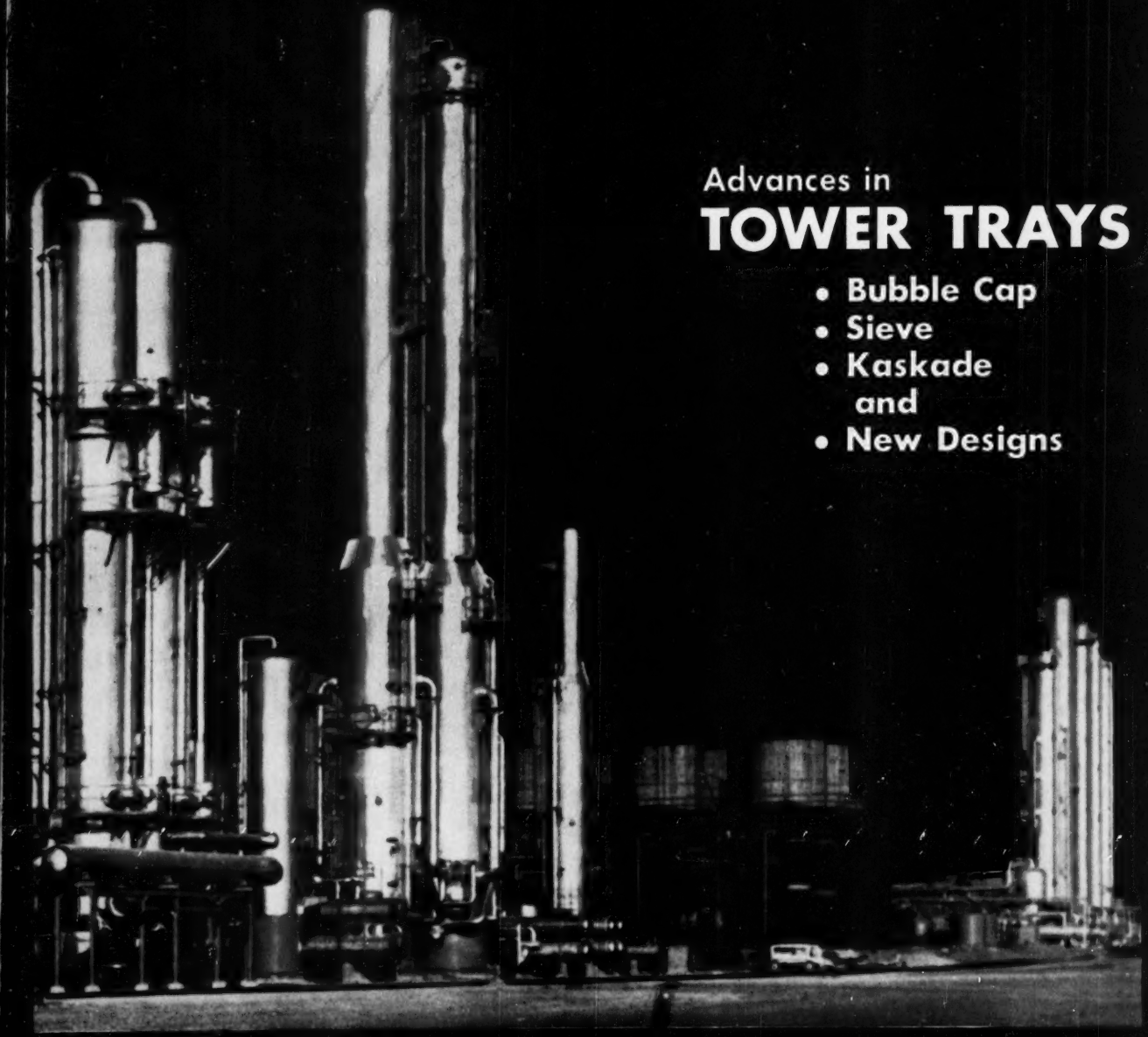


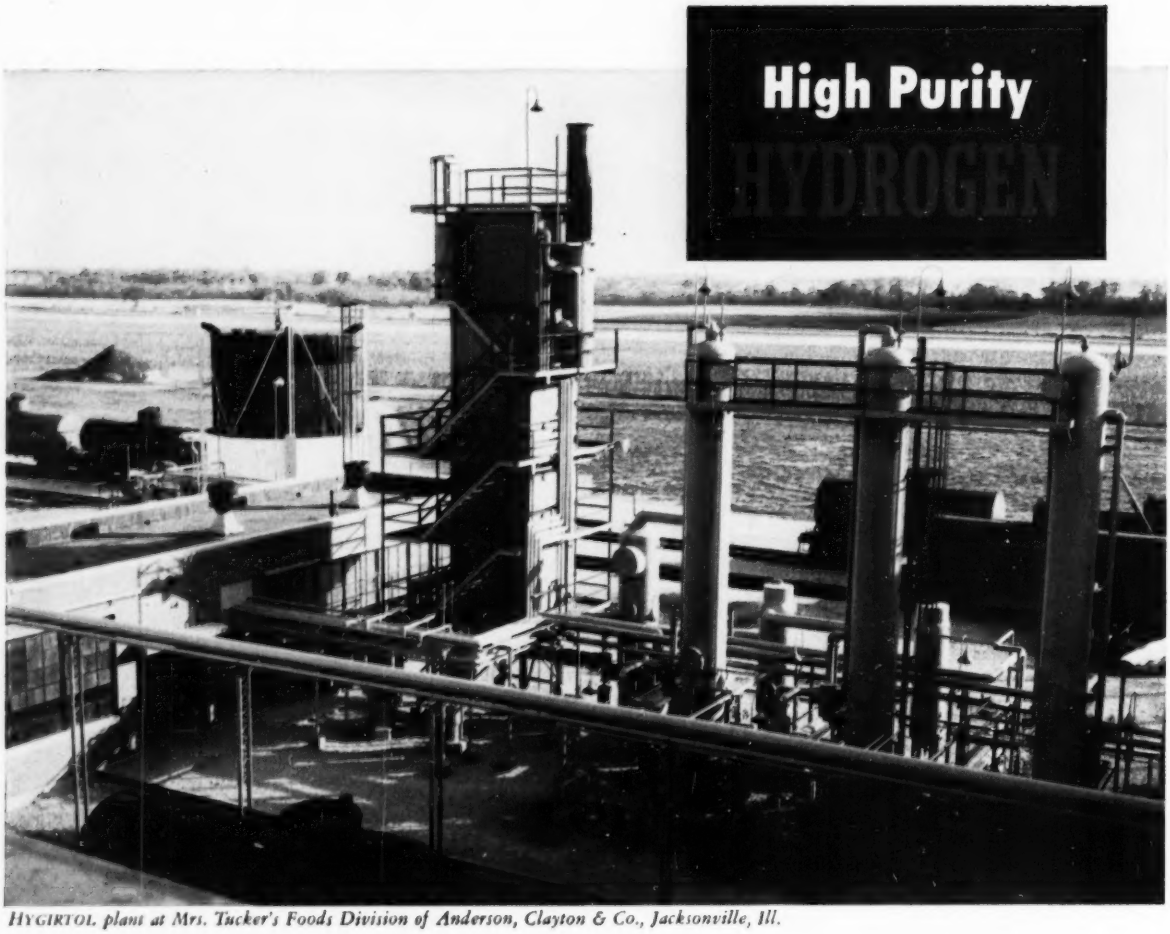
Advances in

TOWER TRAYS

- Bubble Cap
- Sieve
- Kaskade and
- New Designs

A McGRAW-HILL PUBLICATION

ONE DOLLAR



HYGIRTOL plant at Mrs. Tucker's Foods Division of Anderson, Clayton & Co., Jacksonville, Ill.

Another GIRDLER plant for efficient hydrogen production

HIGH PURITY HYDROGEN is required on a continuous basis for large-scale edible oil processing such as at Mrs. Tucker's new plant. This is provided by the Girdler HYGIRTOL* plant shown above. It produces hydrogen exceeding 99.8% in purity, continuously. Operation of the plant is instrument-controlled, practically automatic, safe and clean.

Girdler assumes unit responsibility for all phases of process plant projects such as this . . . their design, engineering, and construction. Coordination and sound results are assured. For further information, call the nearest Girdler office today.

*HYGIRTOL is a trade-mark of The Girdler Company.

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GIRDLER BUILDS processing plants

GIRDLER MANUFACTURES processing apparatus

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Carbon Dioxide Plants
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Plastics Materials Plants
Sulphur Plants
Acetylene Plants
Ammonia Plants
Ammonium Nitrate Plants
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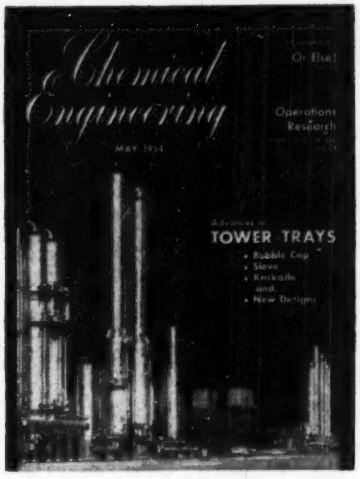
GUIDED TOUR

JOHN R. CALLAHAM, EDITOR



Can't Keep Up?

Then take a long, hard look at our new and enlarged Technical Literature section. It can help you a lot.

There you'll find every month 8 pages listing the latest literature you can get on equipment, chemicals and services in all fields of major interest to chemical engineers.

It's comprehensive, too—by far the most complete inventory of its kind. This month, for instance, you'll find some 355 different items. Where else can you match that?

We've also made changes that help you to find what you want faster, then to get it faster.

All you have to do is to run down the lists, check on the Reader Service postcard the items you'd like to get, mail the card to us. We'll relay your request to the manufacturer within 48 hours. We're now passing along over 15,000 requests every month!

Why not take a look at Technical Literature and give it a try this month? You'll find it on p. 490.—JRC.

. . . . . Tray design is close to the chemical engineer's heart.

Many of our unit operations, such as heat transfer and size reduction, we share with our brethren in the civil, mechanical and mining branches of engineering. But we chemical engineers claim distillation and absorption as our very own.

That's why you'll be sure to read this month's feature articles and news stories on the latest advances in trays for distillation and absorption.

First is a progress report on the Kaskade tray—the advantages it offers, where it's being used. (*Page* 124)

The bubble-cap tray isn't taking its new competition lying down, according to C. F. Braun engineers. (*Page* 128)

Three new tray designs—Uniflux, float valve and Flexitray—deserve careful study by all tower operators. (*Page* 173)

Finally, Celanese discloses new performance data on the sieve tray, helping this old-timer along the comeback trail. (*Page* 179)

Don't be fooled by interest rates!

Money costs money—no matter where you get it. And the best source may not be

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the most obvious. Here's how to keep from getting stung when financing your next expansion or construction project. (*Page* 183)

More about operations research, the new glamour girl of management.

What you have to do if you want to get in on the latest techniques for influencing board-room decisions the right way. How to carve a $25,000 niche. (*Page* 222)

Business girds for competition.

Seventh annual McGraw-Hill capital expenditures survey shows most industries cutting spending through 1957, emphasizing plant modernization. But chemicals plan to spend more in 1957 than this year, concentrating, as usual, on new plants and more new products. (*Page* 339)

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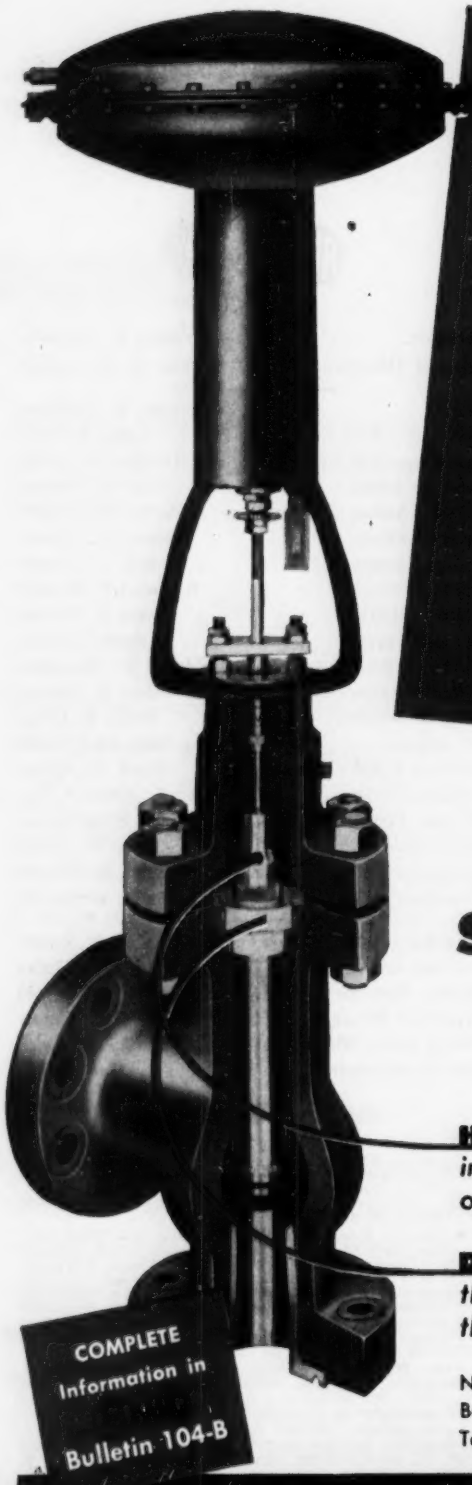

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3600 PSI with TIGHT SHUT·OFF

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HOLO PLUG . . . *balanced to insure accurate positioning and optimum stability of operation.*

DAHL SEAL® . . . *eliminates leakage through the balancing port when the plug is seated.*

Nominal Sizes: 1" to 8"
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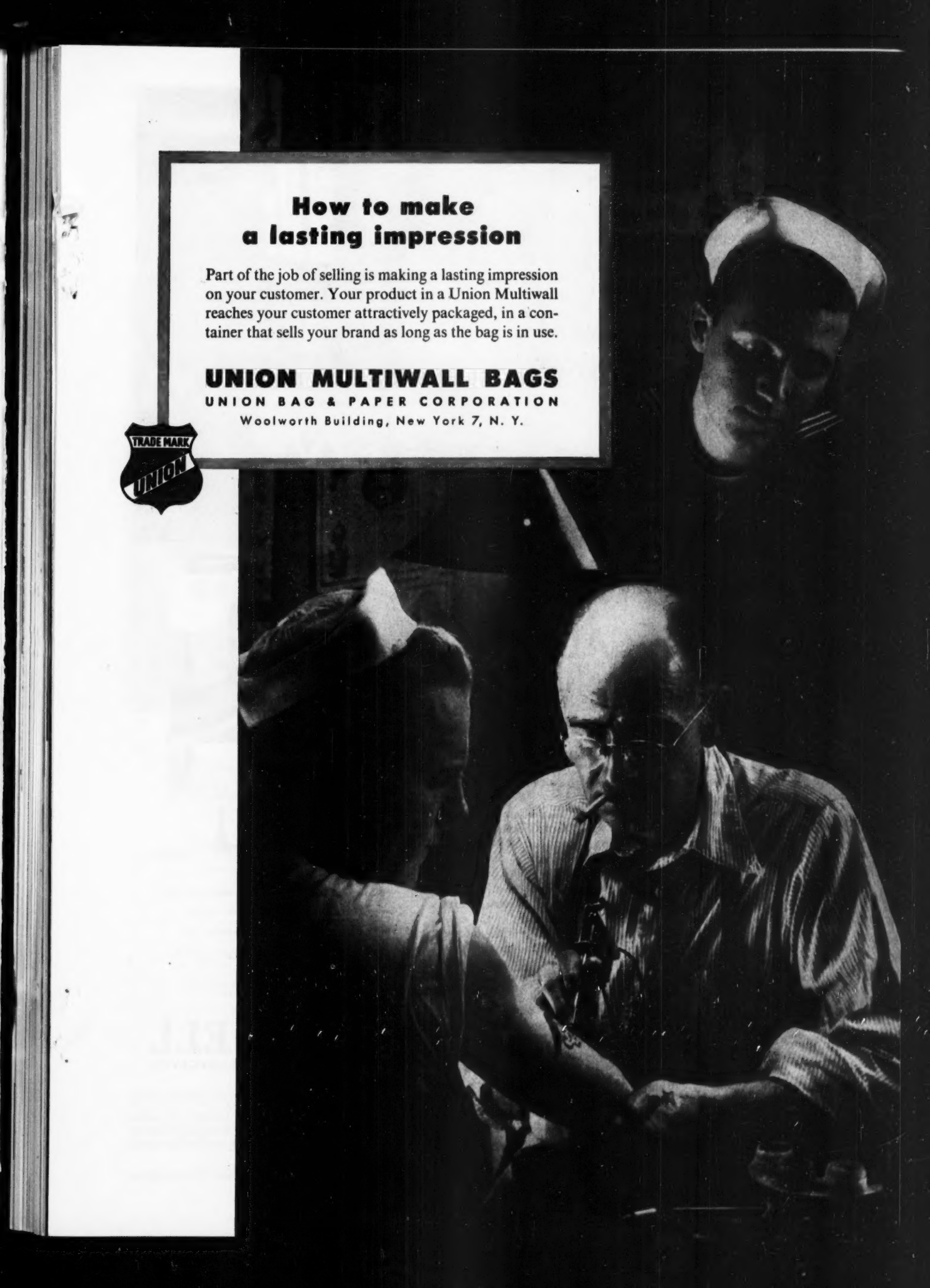
How to make
a lasting impression
Part of the job of selling is making a lasting impression on your customer. Your product in a Union Multiwall reaches your customer attractively packaged, in a container that sells your brand as long as the bag is in use.
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UNION BAG & PAPER CORPORATION
Woolworth Building, New York 7, N. Y.
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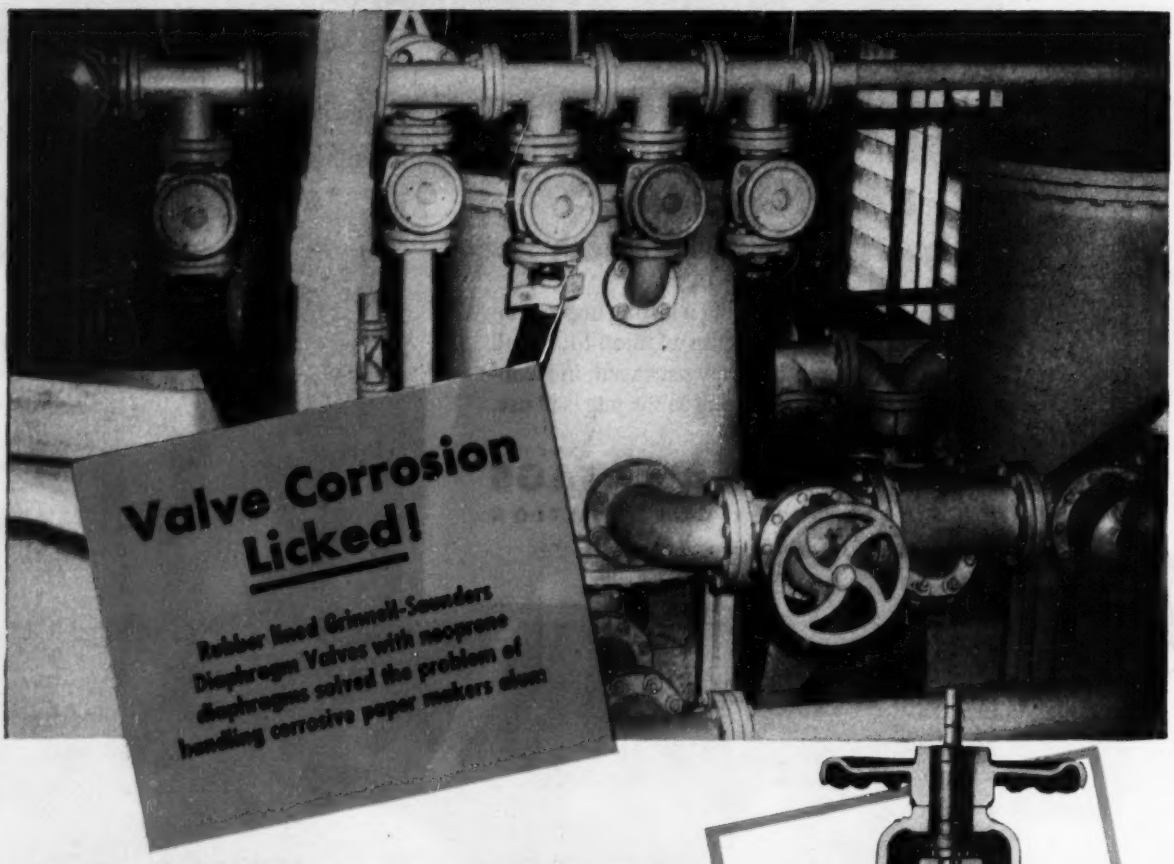

Valve Corrosion Licked!
Rubber lined Grinnell-Saunders Diaphragm Valves with neoprene diaphragms solved the problem of handling corrosive paper makers alum

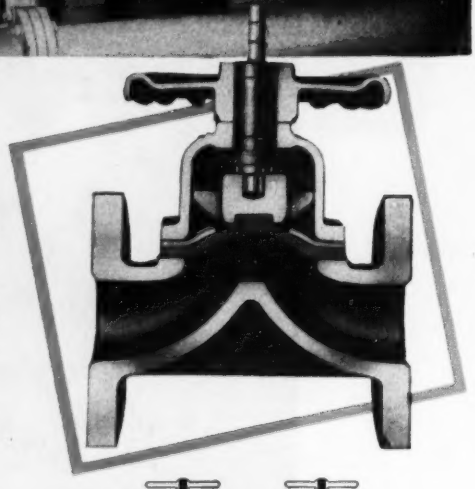
GRINNELL-SAUNDERS DIAPHRAGM VALVES

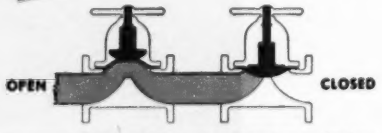
Commercial aluminum sulphate *can be everlastingly troublesome*, as anyone knows who has ever had to work with it. So, comparing notes with a company that handles this chemical every day of its business life may be helpful.

Northern Chemical Industries, Searsport, Me., is an important manufacturer of "paper makers alum". Northern Chemical Industries relies heavily on Grinnell-Saunders Diaphragm Valves. They have found that the wide range of body, lining and diaphragm materials available with Grinnell-Saunders valves offers flexibility in handling a wide variety of corrosive fluids.

The basic design of the valve is an advantage. Working parts are completely isolated from the fluid stream which, in the case of corrosive acids, means longer valve life. Also, there is the matter of economy. With Grinnell-Saunders Diaphragm Valves, it is usually possible to go to less expensive body materials, to which special body linings can be added. Replacement and maintenance expenses, moreover, are greatly reduced.

Originally designed and ideally suited for air and water service, Grinnell-Saunders Diaphragm Valves also are recommended for almost every regular or special service. This is backed up by the excellent performance records achieved by valves now in use.





Features of Grinnell-Saunders Diaphragm Valve:

- Diaphragm absolutely isolates working parts from fluid
- Diaphragm lifts high for streamline flow in either direction
- Diaphragm presses tight for positive closure
- Body, lining and diaphragm materials to suit service
- Simple maintenance — diaphragm easily replaced without removing valve from line

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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Another new development using

B. F. Goodrich Chemical *raw materials*

Be sure to see the B. F. Goodrich Chemical Company Exhibit at the 6th National Plastics Exposition Booth 727 Public Auditorium Cleveland, Ohio, June 7-10

B. F. Goodrich Chemical Company does not manufacture these plastic dip tubes. We supply the Geon resin only.

New Defense against Tank Corrosion

RIGID plastic pipe made from Geon polyvinyl chloride helps cut down internal rust and corrosion in hot water heater tanks. The pipe, or "dip tube", was developed in the search for an answer to an old problem—electrolytic action between different metals used in hot water heaters which can cause corrosion through the steel tank itself.

Because the dip tube is plastic, it does not promote this "battery action" inside the tank.

Geon resin was chosen for the dip tube after exhaustive tests of various plastics under all operating conditions. Perhaps a Geon material can help you reduce or eliminate corrosion where tubing, piping, ducts or tank linings are used. And, Geon materials have many more uses where resistance to many acids, chemicals and water is important. We'll help you select the one best suited to your needs. For information, please write Dept. GE-5, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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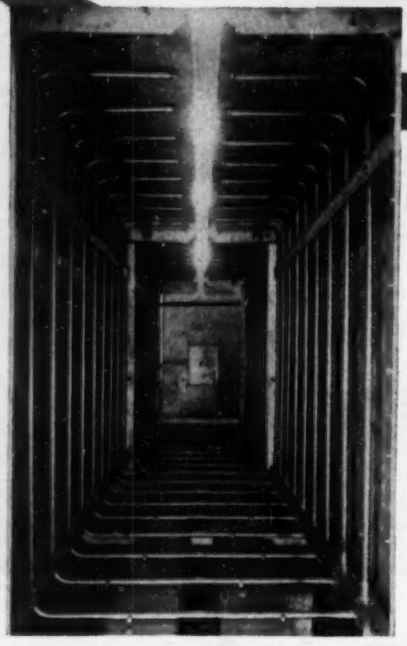
Winning New Friends Fast!

Carpenter Stainless No. 20 for SUPER CORROSION CONTROL of H_2SO_4



Sulphuric Acid Spray Booth fabricated from Carpenter Stainless No. 20 sheets and tubing.

Free Test Coupons will be sent for comparing No. 20 with other materials in your conditions. State type of equipment, corrosion conditions, temperature range, and other pertinent processing information relating to the job you have in mind for Carpenter No. 20. Request from your nearest Carpenter Representative or write direct to the mill.

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Now that this sulphuric-acid resisting stainless steel is again in free supply for unrestricted uses, why continue to put up with ordinary corrosion resistant materials in lines and equipment handling H_2SO_4 and other strongly corrosive agents?

Carpenter Stainless No. 20 stands up under corrosion's most vicious attacks long after the best of others have succumbed. A fast growing number of equipment manufacturers and processing plants are now switching to this super stainless for greater freedom from severe corrosion troubles, extended equipment life, reduced down-time for replacements, and lower costs chargeable to corrosion. You, too, will find that Carpenter Stainless No. 20 is best where corrosive conditions are worst.

In addition to its extraordinary resistance to H_2SO_4 and free sulphate ions up to boiling temperature, Carpenter No. 20 is *completely* resistant to a long list of other strong corrodents including:

arsenic acid benzoic acid carbonic acid citric acid
fatty acid picric acid mixed acids acetate solvents

Tubing, pipe, sheet, and plate of Carpenter No. 20 are available with columbium to facilitate fabrication by welding from . . .

The Carpenter Steel Company
Alloy Tube Division, Union, N.J.

Export Dept.: The Carpenter Steel Co., Port Washington, N.Y.
"CARSTEELCO"

Send for bulletin containing corrosion resistance, properties, performance results, application and fabricating data.

For Carpenter 20 Bars, Strip and Wire Contact The Carpenter Steel Company, Reading, Pa.

Carpenter

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Analysis → Tolerance → Finish →

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You can make your selection with absolute certainty as to *how dry, how much per hour, how well washed if need be, how much it costs, including labor, power, maintenance — everything.*

The Bird Research and Development Center is set up to provide the facts and figures, pilot plant scale.

Bird builds all four types, so findings are completely unbiased. Whatever your solids-liquids filtering or clarifying problem, isn't this the sensible way to approach it? Bring it to BIRD.

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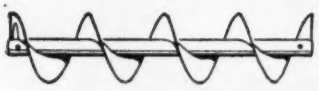
See why Link-Belt screw conveyors are 8 ways better

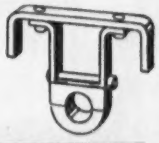


1. LOOK FOR UNIFORMITY OF PITCH

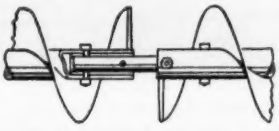
Specialized modern machinery assures accurate forming, producing uniform flighting curvature.

2. ONLY SPECIALLY SELECTED STEELS

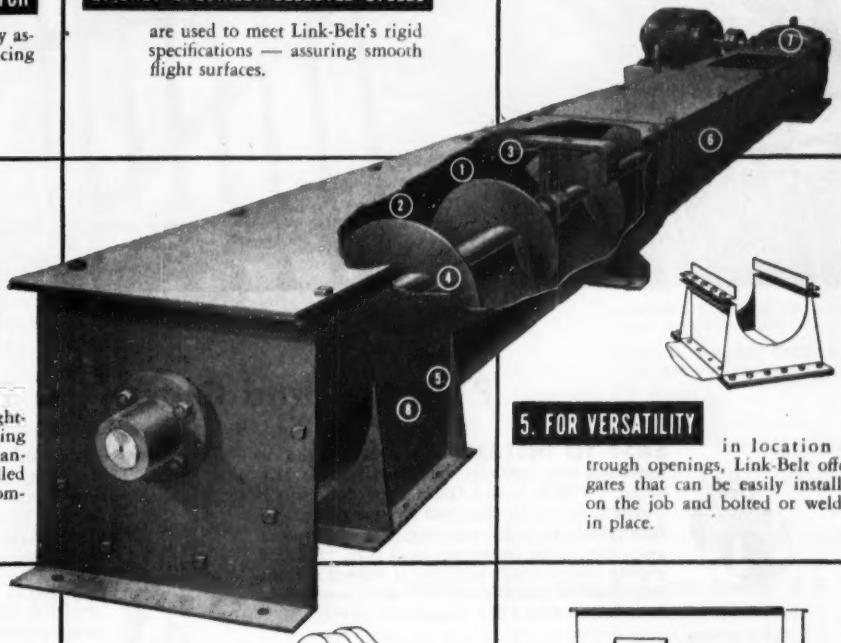
are used to meet Link-Belt's rigid specifications — assuring smooth flight surfaces.



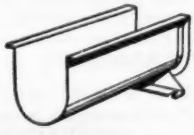
3. HERE'S A WIDE RANGE of hanger styles and mountings with various bearing materials.



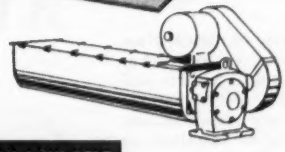
4. FOR YOUR PROTECTION straightness is checked before shipping and extra care is taken in handling and loading. Jig-drilled coupling bolt holes assure complete and easy assembly.



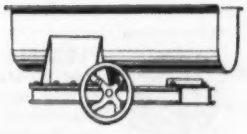
5. FOR VERSATILITY in location of trough openings, Link-Belt offers gates that can be easily installed on the job and bolted or welded in place.



6. YOU'LL DISCOVER that troughs are accurately fabricated to assure better fit of all components. Link-Belt offers a choice of metals to fit your particular application.



7. ONLY LINK-BELT builds a complete integrated line of gear and chain drives, couplings, bearings. One proved source . . . one undivided responsibility.



8. YOUR CHOICE of fixed or detachable plain discharge spouts or gates. Flat or curved slide type gates can be hand or rack-and-pinion operated.

LINK-BELT

SCREW CONVEYORS

These are only a few of the many important differences in screw conveyors. Ask your Link-Belt sales representative or distributor for new 92-page Data Book 2289.

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Petro-Basic Production means the uniformity, purity and price stability of synthetic production . . . the continuity of petrochemical operation, based on integrated raw material supply . . . the dependable delivery provided by a nationwide distribution system that includes bulk storage depots conveniently located in key industrial areas, and a standby fleet of tankcars, tanktrucks and barges.

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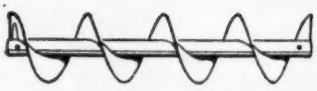

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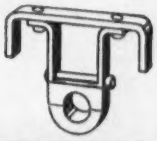
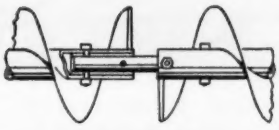
Specialized modern machinery assures accurate forming, producing uniform flighting curvature.

2. ONLY SPECIALLY SELECTED STEELS

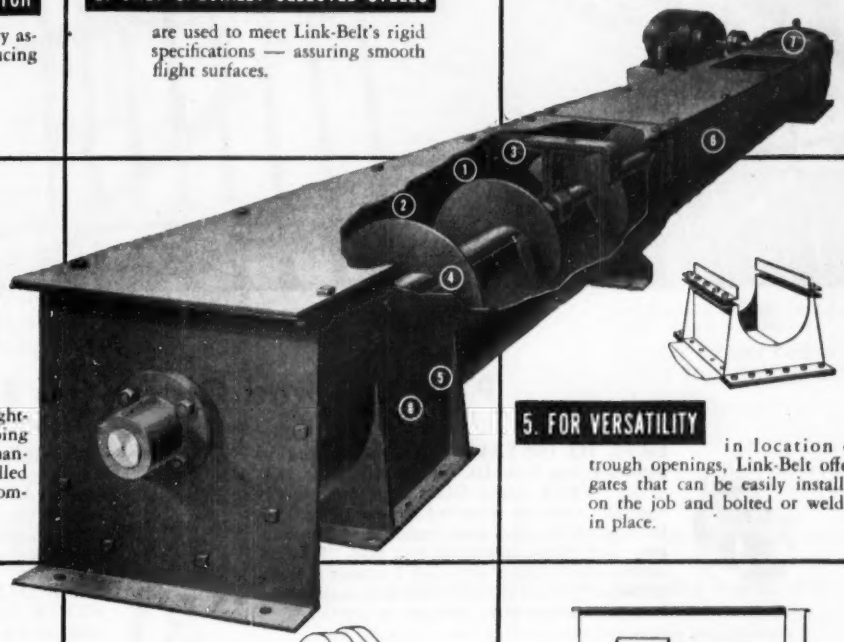
are used to meet Link-Belt's rigid specifications — assuring smooth flight surfaces.



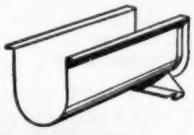
3. HERE'S A WIDE RANGE of hanger styles and mountings with various bearing materials.



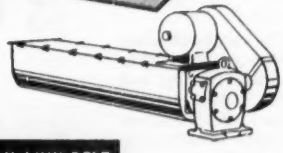
4. FOR YOUR PROTECTION straightness is checked before shipping and extra care is taken in handling and loading. Jig-drilled coupling bolt holes assure complete and easy assembly.



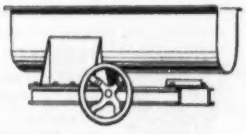
5. FOR VERSATILITY in location of trough openings, Link-Belt offers gates that can be easily installed on the job and bolted or welded in place.



6. YOU'LL DISCOVER that troughs are accurately fabricated to assure better fit of all components. Link-Belt offers a choice of metals to fit your particular application.



7. ONLY LINK-BELT builds a complete integrated line of gear and chain drives, couplings, bearings. One proved source . . . one undivided responsibility.



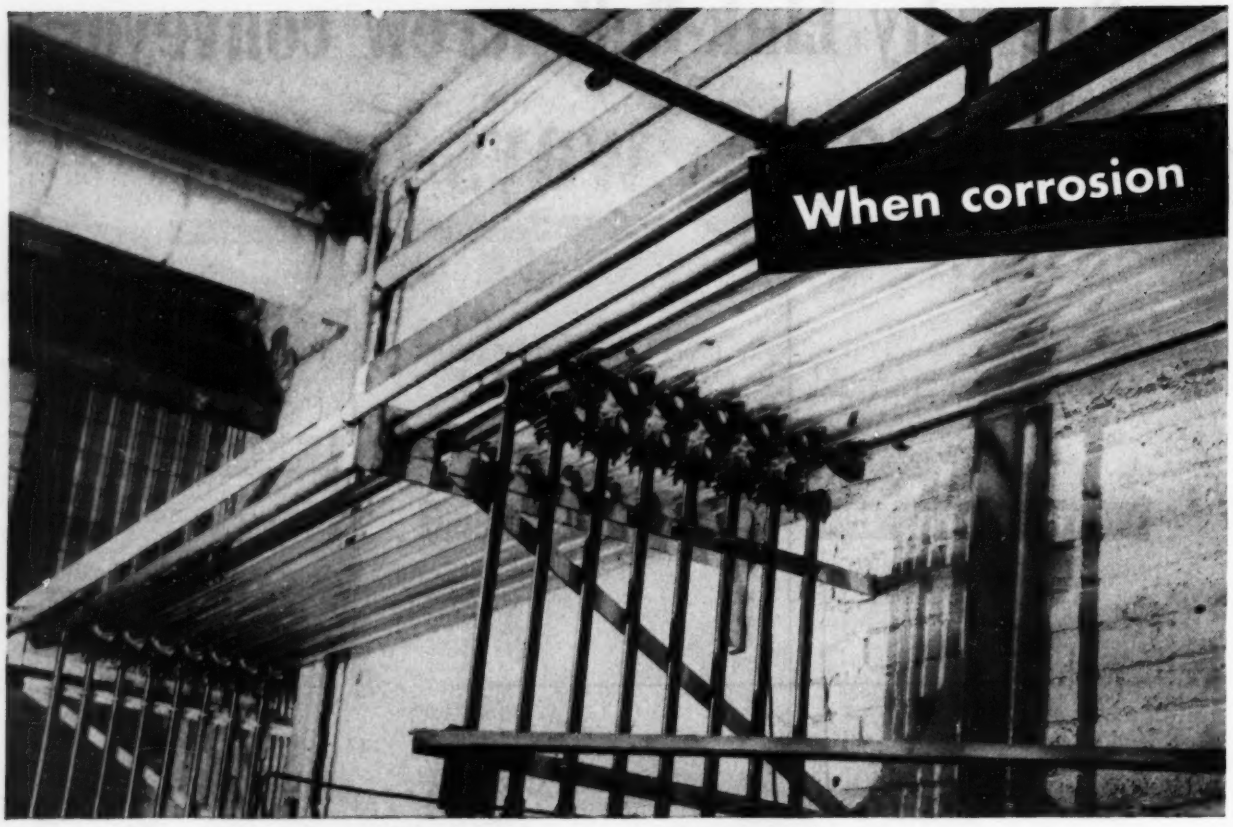
8. YOUR CHOICE of fixed or detachable plain discharge spouts or gates. Flat or curved slide type gates can be hand or rack-and-pinion operated.

LINK-BELT

SCREW CONVEYORS

These are only a few of the many important differences in screw conveyors. Ask your Link-Belt sales representative or distributor for new 92-page Data Book 2289.

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle; Scarboro, Toronto and Elmira, Ont. (Canada); Springs (South Africa); Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities. 10,278



PYREX brand Glass Pipe Features

EASY TO INSTALL. There are tricks to handling any material, but the tricks to handling PYREX brand Glass Pipe are quickly learned. It can be plumbed at your plant. Prefabrication to your requirements is unnecessary. One plant superintendent says, "PYREX piping can be easily installed. I cannot remember when we had any difficulty with installation or reinstallation after changes or repairs."

FLEXIBLE HOOK-UPS. You can hook glass pipe to iron, steel, stoneware or any other piping material. Corning supplies fixtures and adapters to meet most needs. Special fixtures can be made for extraordinary requirements. Says one chief engineer, "Glass installations have the advantage of being flexible, as compared to metallic materials."

IT'S TOUGH. You can't hit PYREX brand "Double-Tough" Glass Pipe with a hammer or slug it with a wrench, but it is a rugged, easy-to-handle material. An acid plant superintendent says, "Its transparent feature more or less insures due care by everyone coming in contact with PYREX pipe." A plant manager says, "We started to work with PYREX pipe in 1937. We've had no breakage to speak of."

VISIBILITY. "Often the visibility afforded by PYREX pipe aids tremendously in the ease with which chemical processes can be carried out," observes the manager of a chlorine plant. *Trouble can't hide behind glass.*

AVAILABILITY. PYREX brand "Double-Tough" Glass Pipe is available in diameters of 1″, 1½″, 2″, 3″, 4″ and 6″ I.D. in standard lengths up to 10 feet. Fittings, including 45° and 90° elbows, tees, reducers, crosses are also available in all sizes. In addition, laterals and U-bends are available in 1″ to 4″ sizes. Plug valves are available in 1″ and 1½″ sizes. Balanced stocks are always on hand. *Send for catalog.*

CORNING GLASS WORKS, CORNING, N. Y.

Corning means research in Glass

eats your pipelines,

specify PYREX® "DOUBLE-TOUGH" Glass Pipe

It's corrosion and heat resistant, transparent, chemically stable, strong —and it can be plumbed in your plant.

The production manager of a well-known chemical plant reports: "Besides our problem of corrosion, the necessity of maintaining color standards for our products has made glass the ideal piping material in some of our processes. We have used glass pipe in this plant for many years and couldn't do without it."

BREAKAGE NO PROBLEM... "We have very slight breakage. A piece of heavy sheet iron separates a glass inlet to a distillation kettle from some nuts that have to be removed occasionally with a wrench. Some close-mesh steel wire netting protects pipelines from overhead catwalks. That's all it takes to make breakage very unlikely. We don't worry about it."

STANDS HIGH TEMPERATURES... "One of our lines is hooked up to a distillation kettle heated by a steam jacket to 195° C. The vapors are condensed in a 3-inch PYREX pipe with cold water jackets. When we change the chemical substance to be distilled, we disconnect the pipe and clean it with steam to remove all traces of the previous distillate, especially the odor. This is a very simple change."

NOW STRONGER THAN EVER... The new PYREX "Double-Tough" Glass Pipe makes breakage even more unlikely. It is made from heavy-wall machine-drawn tubing. A new heat-treating process doubles the strength of the ends of straight lengths and of all standard fittings except U-bends.

Your Corning Distributor stocks PYREX brand "Double-Tough" Glass Pipe and a line of fittings to meet your requirements. Call him today for more detailed information or send the coupon below direct to Corning.

Authorized Distributors of Pyrex brand "Double-Tough" Glass Pipe

BELMONT, CALIFORNIA
Glass Engineering Laboratories

FRESNO 17, CALIFORNIA
Valley Foundry & Machine Works

NEW HAVEN, CONNECTICUT
Macalaster Bicknell Company

ATLANTA, GEORGIA
Southern Scientific Company

CHICAGO 44, ILLINOIS
Fred S. Hickey, Inc.

NEW ORLEANS, LOUISIANA
W. H. Curtin & Company

CAMBRIDGE 39, MASS.
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ST. LOUIS 4, MISSOURI
Stemmerich Supply Inc.

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BUFFALO 13, NEW YORK
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ROCHESTER 3, NEW YORK
Will Corporation

HATBORO, PA.
Sentinel Glass Company

PITTSBURGH 19, PA.
Fisher Scientific Company

HOUSTON 7, TEXAS
W. H. Curtin & Company

SEATTLE 4, WASHINGTON
Scientific Supplies

MONTREAL 3, QUEBEC, CANADA
Fisher Scientific Company, Ltd.

TORONTO, ONTARIO, CANADA
Fisher Scientific Company, Ltd.

VANCOUVER, B. C., CANADA
Scientific Supplies

CORNING GLASS WORKS, Dept. CE-5, Corning, N. Y.

Please send me the printed information checked below.

- ☐ "PYREX brand Glass Pipe in the Process Industries" (EA-1)
- ☐ "PYREX brand "Double-Tough" Glass Pipe and Fittings" (EA-3)
- ☐ "Gasket Materials for PYREX Pipe" (IA-13)
- ☐ "Plant Equipment Glassware for Process Industries" (EB-1)
- ☐ "Installation Manual for PYREX brand Glass Pipe"

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Company_____

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State_____

"Doc Barrett" Helps Feed Formulators Make Faster Fatteners

More Americans than ever are enjoying "chicken every Sunday" (and weekdays, too) without paying any more for it than in the pre-inflationary year of 1944. In the past 15 years our poultry producers have increased broiler output from 100,000,000 to 950,000,000!

Most of the credit for this amazing production record goes to the scientists of the feed concentrate companies and agricultural experiment stations. Working with vitamin-enriched materials, they compounded chicken feeds which produce marketable broilers faster. Result: many more broilers can be raised and sold in less time and at lower cost.

One of the most important ingredients in the new feed concentrates is Barrett Niacin. The food industry is but one of scores which depends upon "Doc Barrett's" help in the development of more and better end products through the use of coal-tar chemicals. It will pay you to know more about "Doc Barrett." He can assure you uniform quality, steady supply and quick delivery. Your inquiries are invited.

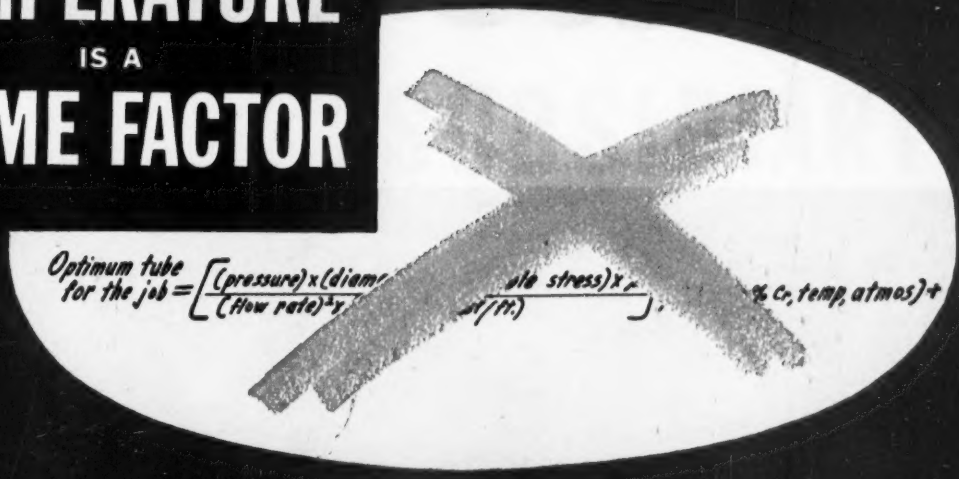
BARRETT DIVISION, Allied Chemical & Dye Corporation, 40 Rector St., N. Y. 6, N. Y. In Canada: The Barrett Company, Ltd., 5551 St. Hubert St., Montreal.

1854 1954 CENTENNIAL Barrett 100 YEARS OF EXPERIENCE

BARRETT NIACIN

CHEMICAL PROGRESS WEEK MAY 17-22

WHEN TEMPERATURE IS A PRIME FACTOR



Tube Selection Cannot Be Reduced to a Formula—Even a Complicated One

Many variables are involved in the selection of the optimum tubing for a specific high temperature application. If the tubing is also to operate under high stress, perhaps the most important variable to be considered is mechanical strength.

In general, the mechanical strength of a steel decreases as the temperature increases. Some steels, however, retain more of their strength at elevated temperatures than others. For instance, at 300F, the ultimate strength of both carbon steel and B&W Croloy 18-8 (Type 304) is about 70,000 psi. At 1200F, however, carbon steel is about 12,000 psi while Croloy 18-8 is about 44,000 psi.

To evaluate the characteristics of metals operating under stress at high temperatures and over long periods of time, B&W has performed stress rupture tests and creep tests on a great number of tubing steels.* The results of these tests help engineers to determine the proper tube to be used in specific applications.

Other factors beside mechanical strength, however, must be considered in choosing the optimum tubing for a specific high temperature application. Some of these factors are—oxidation resistance, tube size, tube cost, flow rates, and rates of conductivity and expansion.

It takes an expert to specify the right tubing for any particular application, and there is no substitute for the kind of experience with these problems you'll find at B&W.

To get the most benefit from B&W's long experience in matching tubes to jobs, call on Mr. Tubes, your nearby B&W Tube Representative. He can help you make the best choice.

Data shown in
TDC 102 Creep Stress Data on B&W Croloys
TDC 153 Stress Rupture Data on B&W Croloys
available free on request.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

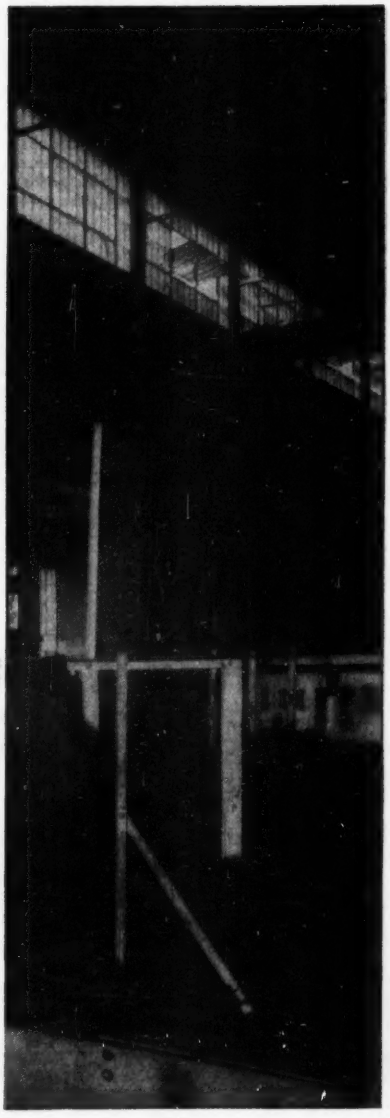
B&W SEAMLESS and WELDED TUBES

TA-4023 (P)

Glascote

Where glass weds steel for corrosive service

. . . A NEW A.O.Smith SUBSIDIARY



This is good news to chemical engineers who seek dependable equipment for corrosive service.

The long experience of Glascote technicians in designing and fabricating glass-on-steel processing equipment is now combined with the parallel experience and unmatched research activities of A. O. Smith in ceramics and metallurgy.

Chemical, petro-chemical, pharmaceutical, plastics and synthetics producers will find this amalgamation of great value to them since corrosion-resistant vessels, tanks, kettles, evaporators, exchangers, and the like, have long been produced by both companies. Between them, they are responsible for an enormous volume of glass-lined steel products, including processing equipment, brewery tanks, *Permaglas* water heaters and *Harvestore* crop storage units.

Look to Glascote and *A. O. Smith* for the corrosion-resistant processing equipment you need . . . in standard or custom designs.

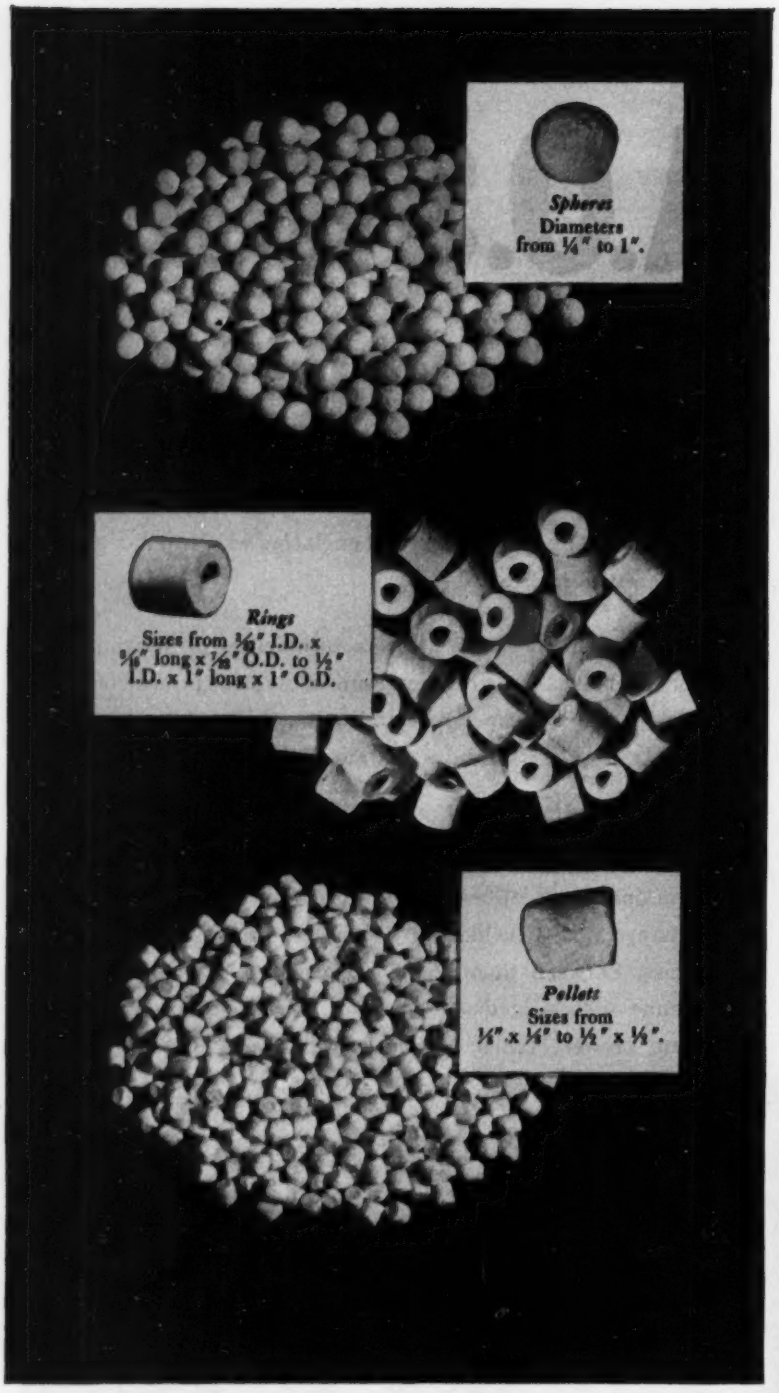
Glascote

PRODUCTS, INC.

CLEVELAND 17, OHIO

A subsidiary of A. O. Smith Corporation

Sales offices or agents in Principal Cities
Export Sales: A. O. Smith Corporation, International Division, Milwaukee 1, Wisconsin

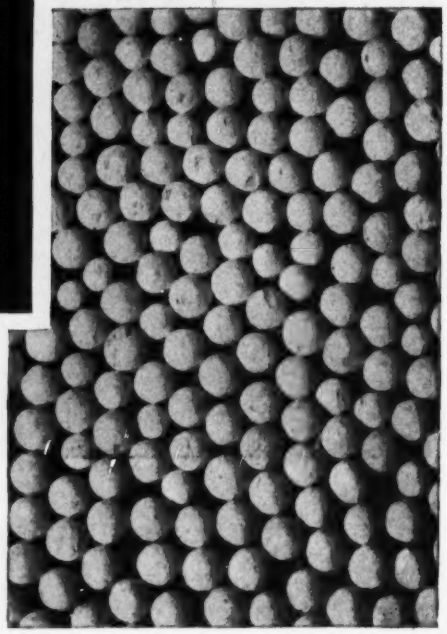


Rx for

Norton catalyst carriers — spheres, pellets and rings — are commercially available in ALUNDUM*, (fused alpha alumina) mixtures. Experimental quantities are available in MAGNORITE*, FUSED STABILIZED ZIRCONIA, CRYSTOLON* and MULLITE.

Norton spherical carriers provide uniform beds in catalytic converters, reducing channeling and pressure drop to a minimum. Medium porosity spheres have porosity ranging from 40% to 44% with a network of open pores on the outside surface only. These are suitable for applications where the carrier is coated with a catalyst. High porosity spheres have porosity ranging from 45% to 49%, with a network of open pores on the outside surface as well as throughout the entire sphere. These are suitable for applications where the carrier is impregnated with a catalyst.

Norton ALUNDUM carriers are proving highly successful in reaction such as those involved in the manufacture of phthalic anhydride, maleic anhydride and oxidation of ethylene. Containing 77% to 89% alumina, they are outstanding for chemical stability and resistance to abrasion and erosion. Write for Bulletin #7, containing additional data on ALUNDUM catalyst carriers.



Norton heat exchange pebbles are made of ALUNDUM. Because of their high alumina content (over 95%) they are ideally suited for pebble type heaters, where they are important as the heat-transfer medium, whether oxidizing or reducing conditions are encountered.

Their ability to withstand abrasion, impact and repeated heating and cooling makes them ideal for heat exchange beds of either the static or moving type. Their high refractoriness prevents softening or incipient fusion at any point in the upper bed. This keeps them from "bridging" together and causing stoppages in a moving bed. ALUNDUM heat exchange pebbles are available in ¼, ⅜, ⅝ and ½" diameters.

higher production... better processing...lower costs

Norton refractories are engineered for top performance — and prescribed for many chemical applications

For your refractory uses, Norton refractory products are *engineered and prescribed* to give you the best possible ℞ — the most effective combination of physical characteristics plus thermal, chemical and electrical properties.

The ℞'s you need to improve and economize your processing are ready for you in this complete, top-quality line. For details, including expert technical aid, call in your Norton Refractories Engineer. Meanwhile, write for the fact-filled bulletins, mentioned in this advertisement, that cover your particular requirements for dependable, money-saving refractories. NORTON COMPANY, 504 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

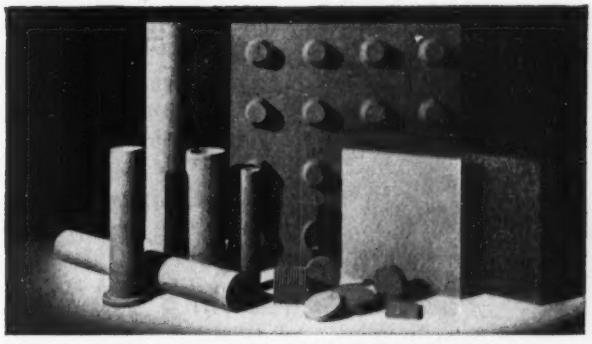
NORTON

REFRACTORIES

Engineered... ℞... Prescribed

Making better products... to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



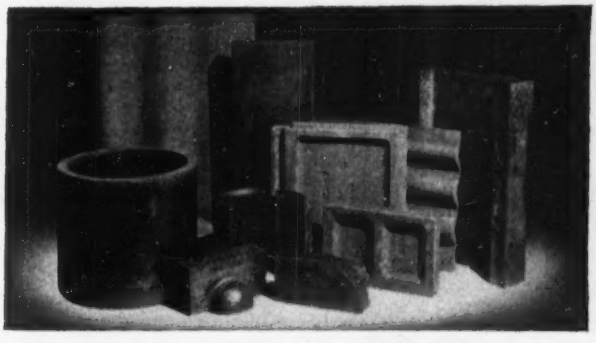
Norton porous mediums come in plates, tubes, discs and diaphragms, engineered to fit your filtering, diffusing or aerating requirements. All have uniform porosity, in the size and open-pore ratio you need. Made of ALUNDUM material that is chemically stable and strong. Thus, their resistance both to acid and alkaline conditions gives them extra long life. Norton seamless porous tubes have the advantage, unusual in tubes, of uniform porosity over their entire area — permitting constant air or liquid pressure and enabling uniform backwashing to do more thorough cleaning.

Typical applications are filtering water or solvents; cutting oils, wine and other liquids; reclaiming cleaning fluids; handling industrial oil wastes. Bulletin No. 140 tells you more about Norton ALUNDUM porous mediums.

Norton electric furnace shapes and laboratory ware

Norton electric furnace refractories — cores, tubes and muffles — are made of ALUNDUM or CRYSTOLON materials. ALUNDUM shapes, composed of 99% pure fused alumina, are characterized by great stability, chemical inertness, excellent thermal conductivity and good electrical insulation qualities. CRYSTOLON shapes, for use under more limited conditions, combine high thermal conductivity with resistance to heat shock. Bulletin No. 458 tells how to construct electrical furnaces for the laboratory.

Norton ALUNDUM laboratory ware, available at your laboratory supply house, offers many properties important to development, experimental or analytical work. It is chemically stable, stands temperatures up to 1900°C and is easy to clean. For filtering, it comes in four degrees of permeability. Bulletin No. 793 gives you the whole story.



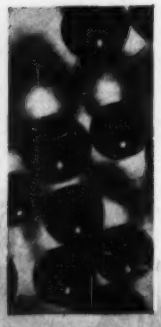
Norton refractory shapes for reaction furnaces come in bricks, plates, tubes and blocks, made of ALUNDUM, CRYSTOLON, MAGNORITE and FUSED STABILIZED ZIRCONIA refractory materials. The development of FUSED STABILIZED ZIRCONIA is a typical example of how Norton aids you in utilizing higher temperatures for greater efficiency and output. Norton was the first to bring this valuable material out of the experimental stage into commercial production. Now it is used in many processes.

No other refractory is so chemically stable at such high temperatures under both oxidizing and reducing conditions. In gas synthetic processes, furnaces lined with it have withstood temperatures approaching 4700°F for long periods. Its low thermal conductivity (6.2 BTU in dense shapes at 2000°F) and its high electrical conductivity at high heat are other important properties, all of which are described in Bulletin No. 1409.

Which of these

PERMUTIT ION EXCHANGERS

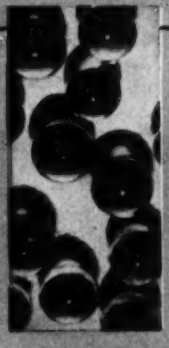
fits your needs?



PERMUTIT Q

High capacity sulfonated styrene cation exchange resin. Extremely resistant to wide pH ranges, high temperatures and oxidizing agents. Can be economically regenerated with salt.

Widely used for water softening and conditioning in mixed-bed and two-step demineralization. Recovers valuable zinc from textile wastes—is gaining new applications in the metal plating field.



PERMUTIT S

Quaternary amine, anion exchange resin that is ionized even at high pH values. Removes anions of WEAK acids as well as STRONG mineral acids.

Can remove silica in feedwater to below 0.01 ppm with economical regeneration. A second important use—chromate recovery from plating and anodizing wastes.

ZEO-KARB®

Sulfonated coal. Very efficient for removing metal cations at low concentrations. Can be regenerated with salts or acids.

Used for recovery of copper from textile wastes, and as a combination adsorbent and cation exchanger in sugar purification.

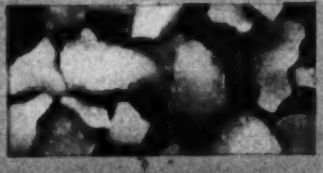
DE-ACIDITE®

An aliphatic amine, anion exchange resin. Removes anions of only strong acids. Tough structure and high capacity—plus high reaction speed.

Very economical for feedwater demineralization where silica is no problem. Uses range from residual sulfate removal in vitamin manufacture to removal of acid and inactivation of pepsin in the treatment of stomach ulcers.

DECALSO®

A precipitated gel type sodium aluminosilicate of medium exchange capacity. Used as an adsorbent in pharmaceutical manufacture.



. . . only Permutit makes all types of Ion Exchangers and Equipment

For over 40 years Permutit has been developing and producing ion exchangers to meet the most rigid specifications.

Continuous quality control gives you a reliable product that equals or exceeds ratings. Each production run is carefully set up with continual testing and supervision during manufacture, and complete testing before shipment.

Permutit's research files contain a world of information on all types of ion exchange applications . . . can save you much valuable time in planning new uses to improve your processing.

Why not investigate the possibilities for your own industry? Your inquiry will receive careful study from our experienced staff. And, since Permutit is the only manufacturer of all types of ion exchangers and equipment, you are assured of unbiased recommendations. Samples of the proper ion exchangers will be provided at no cost for your experimental work.

For information, write to THE PERMUTIT COMPANY, Dept. CE-5, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

Ion Exchange Headquarters for Over 40 Years

PERMUTIT®

PERMUTIT A

Moderately basic anion exchange resin that removes weak acids from solution. Applications include removal of acids from organic solutions such as formaldehyde.

ZEO-DUR®

Processed glauconite (naturally occurring greensand). It is rugged, rapid, long-lived. Can be quickly regenerated with salt.

PERMUTIT H-70

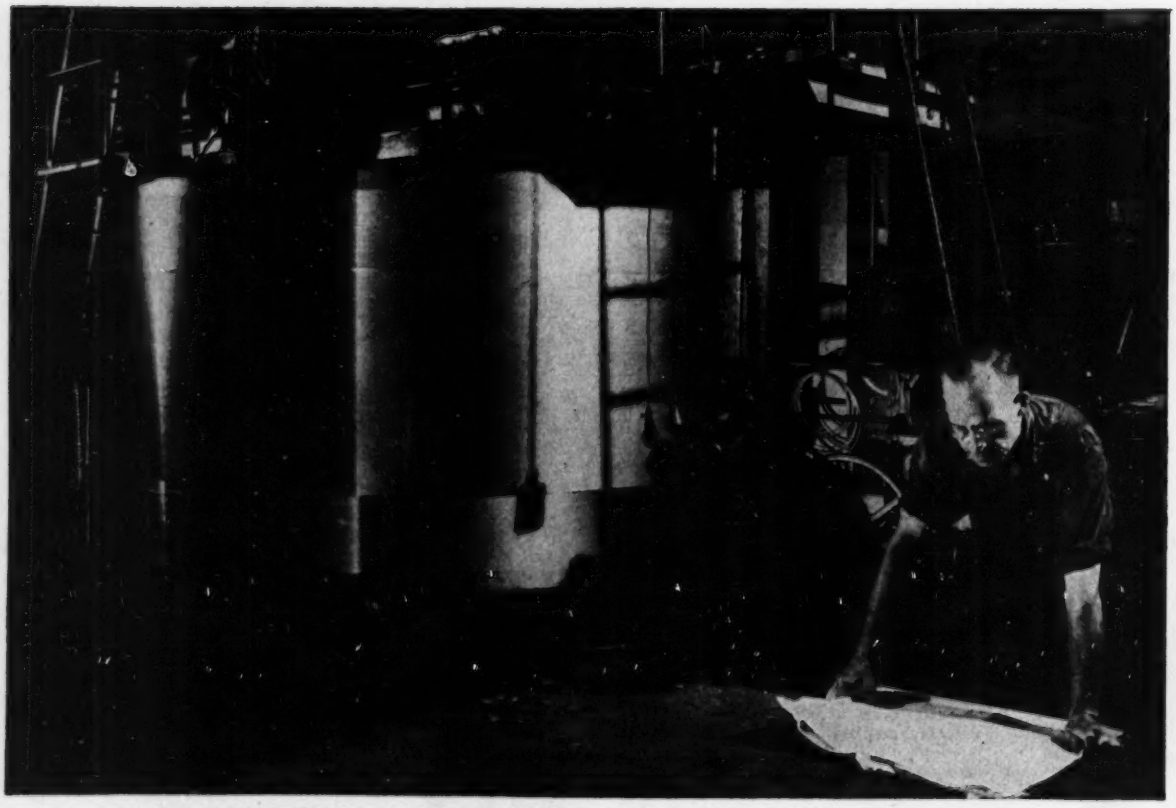
Very high exchange capacity carboxylic acid resin. Very efficient on regeneration by acid. Used for separation of amino acids, alkaloids, antibiotics, etc.

PERMUTIT FOLIN

Modification of Decalso. Widely used in laboratories for determining ammonia by the Folin method. Also used in pharmaceutical manufacture.

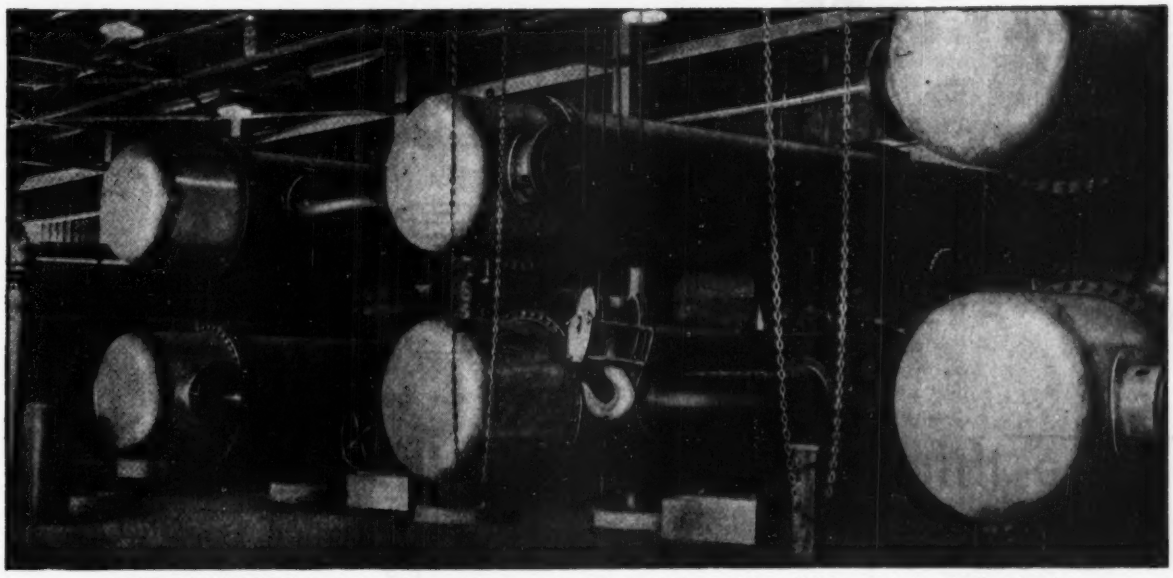
Profit-building answers to Modern

...examples of the wide variety of heavy-metal equipment designed and built by Alco to meet today's demands in petroleum and petrochemical processing . . . results of **Alco Experience** . . . gained through many years of designing and building heavy-metal equipment for refining and processing companies the world over . . . and **Alco Facilities** . . . capable of handling economically an extremely wide range of metal-fabricating operations . . . of meeting strictest customer specifications.

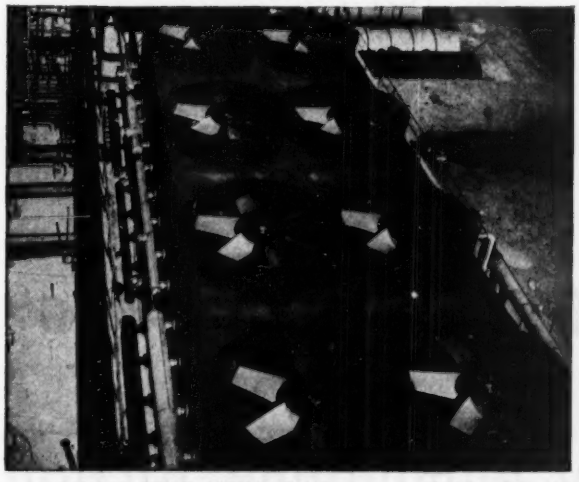


LARGE-DIAMETER BORING MILL, equipped with two rail heads and capable of handling work 25 ft 0 in. high, is typical of the complete, modern production facilities in Alco's shops which can produce virtually every type of heavy-metal equipment for the petroleum, chemical and power industries.

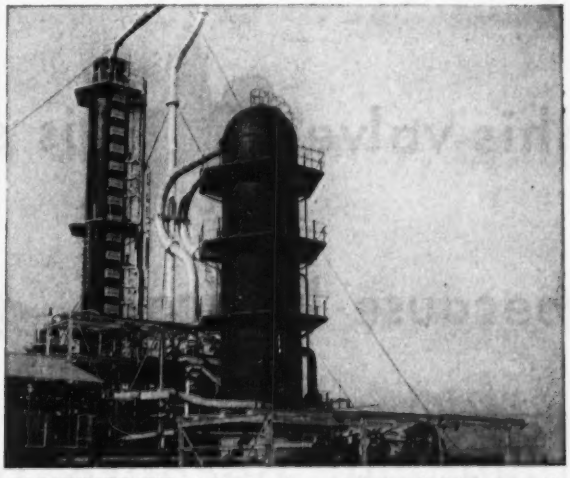
Processing problems



HEAT EXCHANGERS, built by Montreal Locomotive Works, Ltd., an Alco affiliate, ready for final piping in the Edmonton plant of The Canadian Chemical Company, Limited. Heads, tubes and tube sheets of these exchangers are fabricated of Type 316 stainless steel. MLW has supplied more than 200 heat exchangers and reboilers for this gigantic new installation.



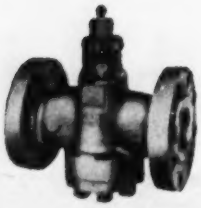
AIR-COOLED HEAT EXCHANGERS were supplied by Alco for Celanese Corp., of America's new Pampa, Texas, plant. Mounted in 17- by 24-ft induced-draft housings, each cooling bank is equipped with two Monel fans supported on silicon rubber. Total heat dissipation from this specially engineered installation is 229,400,000 Btu per hr, a record for air-cooled condensers.



WORLD-WIDE USE of Alco equipment is typified by the wide range of Alco coolers, exchangers, condensers and heaters in service at the Aquila refinery in Trieste, Italy. Operating on Middle Eastern crudes, Aquila's annual capacity is over 900,000 tons with products including high-octane gasoline, top-quality lubricating oils and several types of asphalts and paraffin waxes.

You can find your own profit-building answers by using Alco facilities and experience on your processing problems. Contact your nearest Alco Products sales representative today. Offices in Dunkirk, New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa and Beaumont.

ALCO
PRODUCTS
AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, N. Y.

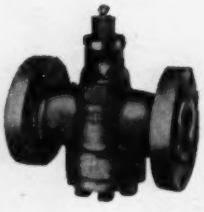
THIS  is a remarkable valve, as

Lubricant goes in through

grooves in the plug . . . . and body

three things—it lubricates the seat . . .

acts as a hydraulic jack . . . . to keep the

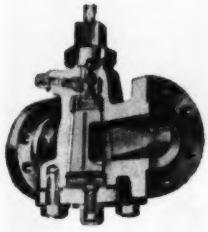
this valve  is safer, because it can

because lubricant stops seepage

because, by eliminating friction

most valves. What kind of valve is it?

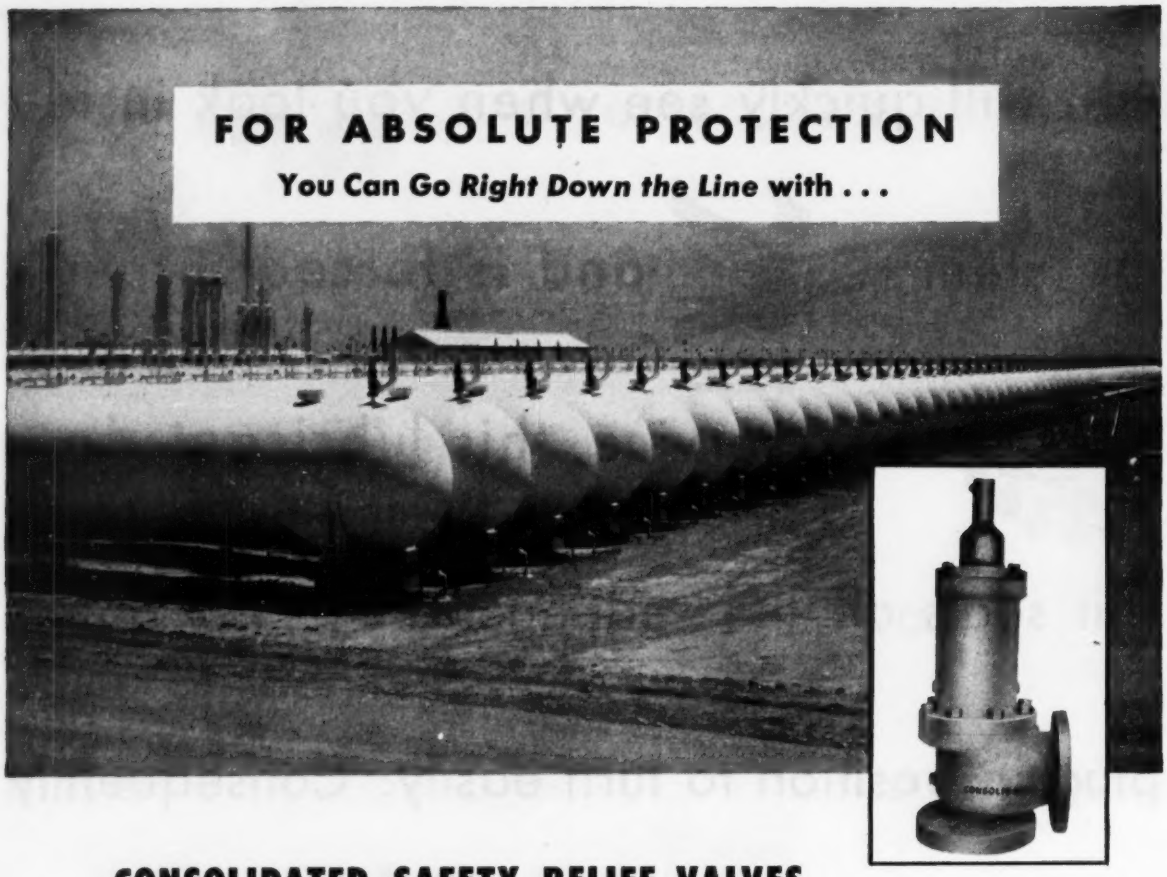
by **ROCKWELL** Manufacturing Company,

you will quickly see when you look inside the stem and is forced through  .. In service, this lubricant does —it seals off the seating area .. .and it plug in position to turn easily. Consequently always be operated in an emergency, and, before it starts. It's also more economical and abrasion, lasts much longer than

Naturally, it's **ROCKWELL-NORDSTROM,**

Pittsburgh 8, Pennsylvania.

Canadian Licensee:
Peacock Brothers Limited



CONSOLIDATED SAFETY RELIEF VALVES

COMPLETE PROTECTION for personnel, property and equipment rates top priority in safety engineering wherever industry must confine gases, vapors and liquids in unfired pressure vessels. That is why Consolidated Safety Relief Valves are such a common sight on processing facilities, pipelines, pumps and storage tanks.

Consolidated Safety Relief Valves incorporate design and construction features that assure *dependable tightness* under the severest discharge piping stresses. Unfired pressure vessels are absolutely safeguarded against overpressures. No matter how tough the conditions of use, you can be sure of continuously reliable performance at the rated capacity.

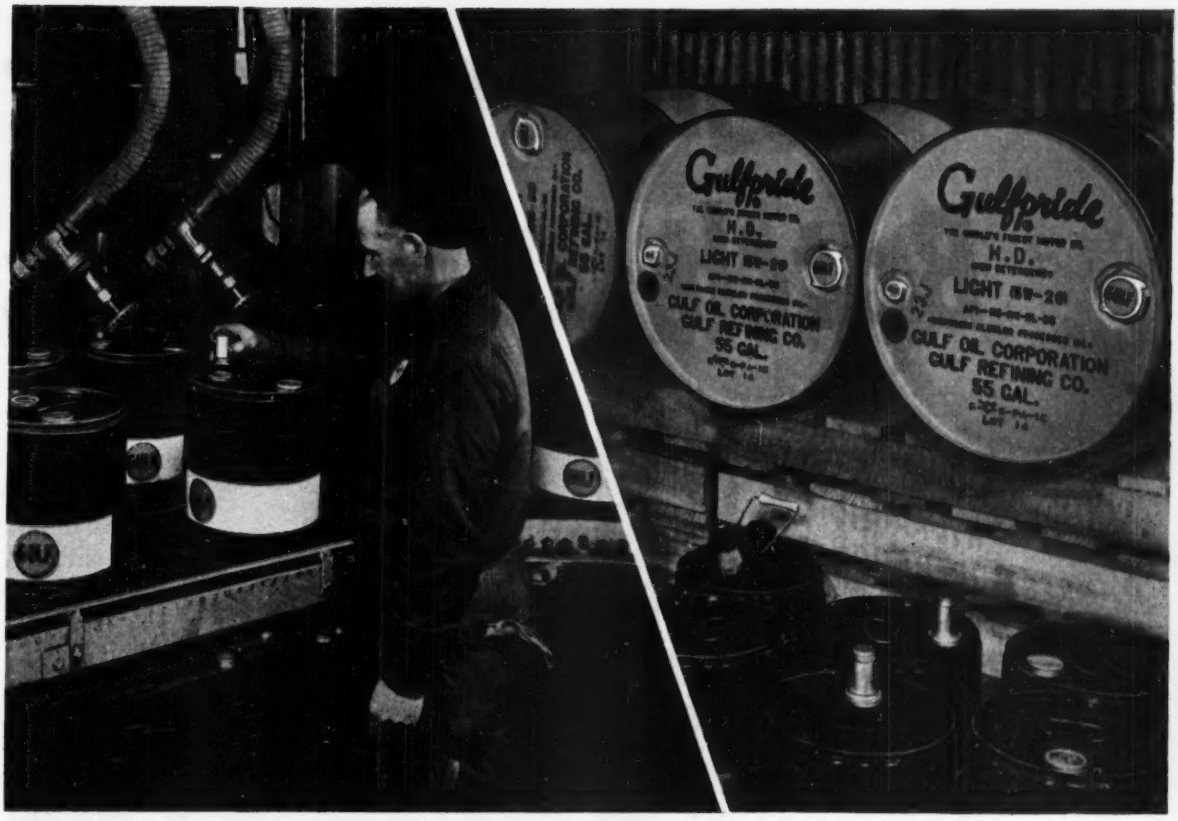
SIMPLE DESIGN — 25% fewer parts than ordinary safety valves — means that Consolidated Safety Relief Valves minimize maintenance and standardization problems and save in long-life operation.

Write for complete information.

CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.



Millions of gallons of GULF oils *in drums and pails* are protected by

Tri-Sure
Reg. U. S. Pat. Off.
CLOSURES

Gulf – an American Flange customer for over 25 years, and one of the world's leading shippers of oil and gasoline – is known for the excellence of its *packaging* as well as its *products.*

Gulf facilitates filling and shipping... protects the purity of oils in transit... delivers containers that are easy to open and use... by equipping *drums* and *pails* with *Tri-Sure* Closures.*

The Gulf Oil Corporation has used the Tri-Sure Closure since its inception – entrusting millions of gallons of its fine products to *Tri-Sure protection.* And every shipment proves that *it pays to specify Tri-Sure:* the Tri-Sure Flange, Plug and Seal for drums... Tri-Sure Nozzles, Spouts and Seals for pails.

On your next order for drums or pails, make it an order for *dependable protection* by specifying "Tri-Sure Closures".

**The "Tri-Sure" Trademark is a mark of reliability backed by over 30 years serving industry.*

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Tri-Sure Products Limited, St. Catharines, Ontario, Canada

Why Automatic Batch Operations

HYDRAULIC PRESS OPERATION

•

BATCH CHARGING AND DUMPING

•

PLASTIC MOLDING OPERATIONS

•

HYDROGENATION OF EDIBLE OILS AND FATS

•

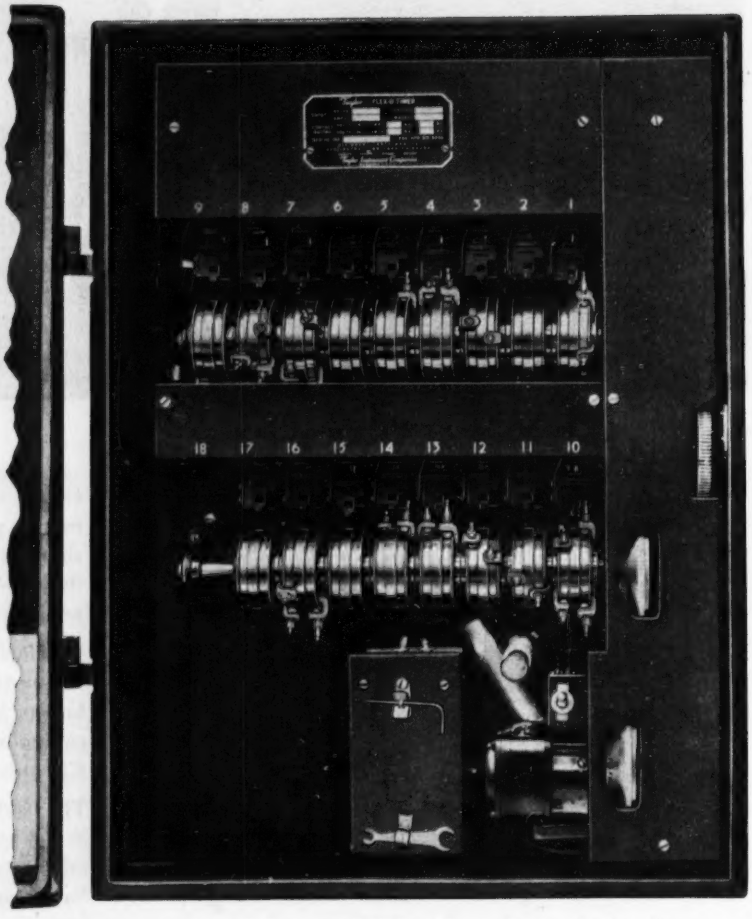
DRY ICE MOLDING

•

BACKWASHING OF CATALYST AND FILTER BEDS

•

RUBBER VULCANIZING



The Taylor FLEX-O-TIMER Time Cycle Controller

MADE in five different models, for applications requiring from one to thirty-six pneumatic or electric operations or any combination of the two. Available with either fixed or adjustable speed drives. Control functions are accomplished by pneumatic valves and electric switches, connected mechanically to latch-operators. These operators are set in motion by actuating pins located on a specially designed cycle drum, driven by a synchronous motor through a gear train and set to complete one revolution each cycle or time period.

Sequencing of AVE DOLLAR$ . . .

. . . because the Taylor FLEX-O-TIMER® Time Cycle Controller "does its own thinking"—takes care of as many as 36 operations automatically, thus saving operator man hours!

THIS dividend-paying instrument is the Taylor FLEX-O-TIMER Time Cycle Controller. It provides precise, automatic timing of the sequence and duration of processing operations involving temperature, pressure, mechanical motion, electrical energy or combinations of each. It does this precisely in accordance with predetermined schedule. And merely pushing a button sets this controller in operation to sequence all of the required process functions. There are hundreds of applications throughout industry where this versatile controller can insure greater uniformity of processing, save operator effort—both physical and mental—and save you money. If you say "yes" to any of these questions it will pay you to call in your Taylor Field Engineer now.

Q. Do you have batch processes requiring personnel to perform multiple operations in sequence with complete reliability?

A. The Taylor FLEX-O-TIMER Controller enables you to coordinate batch processes to meet the requirements of a continuous process. You don't have to rely on people to turn the valves or perform other operations at the right time; e.g., the regeneration of a contaminated catalyst bed in a continuous process. The FLEX-O-TIMER Controller will:—stop the process; clean out process fluids; backwash the bed—or burn out the impurities; put the unit back on stream. All this automatically and in accordance with the best practices.

Q. Are you faced with reprocessing and consequent costly waste if certain manual operations do not take place at the right time, in the right sequence and for the correct duration?

A. You eliminate the possibility of human error with this robot brain in control. You can depend on the FLEX-O-TIMER Controller to turn the valve, pull the switch or perform other operations—automatically; e.g., the molding of plastics or vulcanizing of golf balls.

Q. Can customer dissatisfaction ever be traced to variations in product quality due to processing irregularities?

A. Once you've developed the optimum time, temperature, pressure and other variables for a process you can be sure of repeating that process *exactly,* time after time; e.g., backwashing of filter beds in a continuous process. Result: You are assured of a uniformly high quality product—the secret of repeat business.

Q. Wouldn't you consider it a good investment if a completely automatic sequencing control system applied to your batch processes paid off in a year or less?

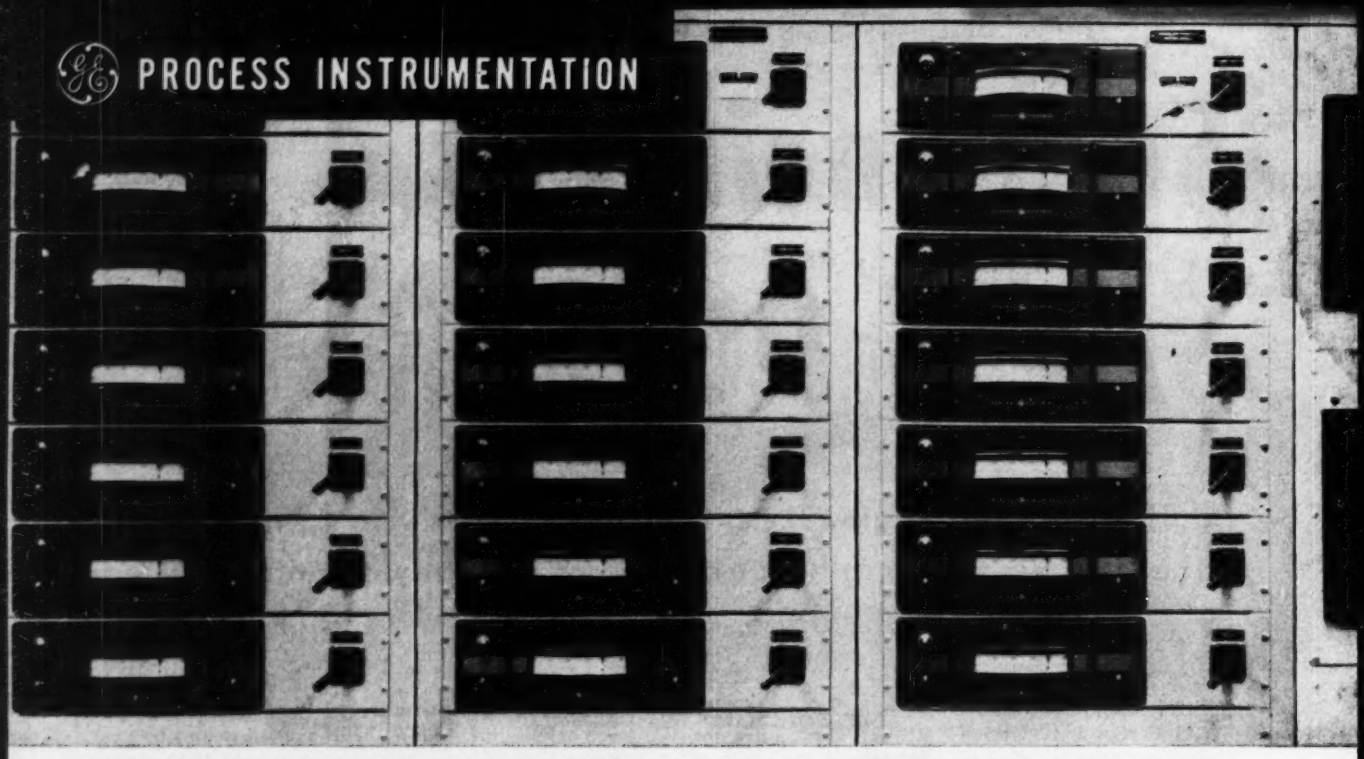
A. Many chemical plants have increased their profits by revamping their batch processes in this way, using the Taylor FLEX-O-TIMER Controller as the key instrument; e.g., the operation of hydraulic presses in removing excess chemical from fibrous materials; plastic press operation; dry ice molding; the lamination of plywoods; tire molding; the opening and closing of dump valves in paper pulp bleach cells; the batch hydrogenation of edible oils and fats.

Q. Why is this system so successful?

A. Because Taylor Instrument Companies have the necessary experience and know-how to apply instrumentation of this kind to the best advantage in many diversified industries. Taylor Engineers have acquired this skill through many years of working in the field with instrument men and engineers. Their knowledge is at your disposal. Why not write today! Also ask for **Bulletin 98154.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

PROCESS INSTRUMENTATION



G-E PYROMETER CONTROLLERS ON ENAMELING FURNACES PROVIDE CLOSE TEMPERATURE CONTROL, PREVENT HEAT DAMAGE TO PRODUCT.

Protect Heat Processes in Three Ways With G-E Pyrometers and Accessories

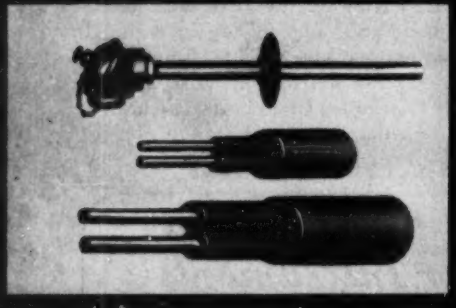
Uncontrolled heat can inflict costly damage on the payload of your furnace. General Electric pyrometer controllers are designed to prevent this kind of production loss in three ways.

3-WAY PROTECTION AGAINST HEAT DAMAGE is provided on G-E pyrometer controllers at no extra cost. Heat is automatically shut off, whenever: a thermocouple fails, power to the instrument is disrupted, or a tube burns out or loses emission.

PRICES START AT $215.78*. Available in 2- or 3-position models, with a variety of ranges in the 0-3000F span.

**Manufacturer's suggested retail price.*

NEW BULLETIN SHOWS HOW TO SELECT THERMOCOUPLES AND WIRE FOR BEST RESULTS



SECTION B602-283
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, N. Y.

Please send me a copy of the bulletin(s) checked below:

.....HP Pyrometers, GEC-713

.....Thermocouple and Thermocouple wire, GEC-714

Name.....
Company.....
Street.....
City.....Zone.....State.....

SPECIAL DESIGN for special application is your assurance that G-E thermocouples and wire will perform well.

TO HELP YOURSELF in selecting the thermocouples and wire best suited to your specific needs, send today for G.E.'s selection guide.

FOR MORE DETAILS, send in coupon or contact your Apparatus Sales Office.

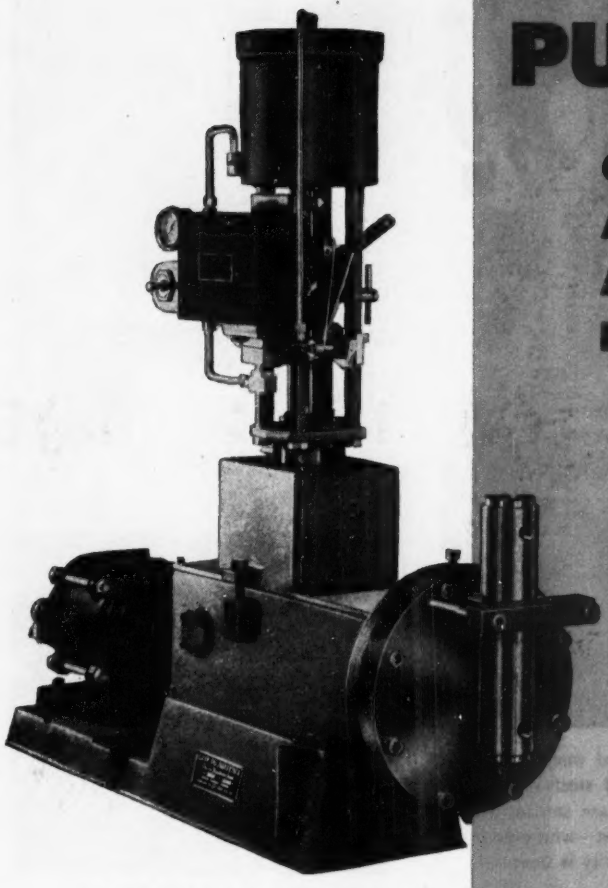
GENERAL ELECTRIC

NOW!

Lapp *Auto-Pneumatic* PULSAFEEDER

OPERATES AT FULL CAPACITY AND FULL RATED PRESSURE

The Lapp Auto-Pneumatic Pulsafeeder has made possible automatic continuous processing in many processes involving chemicals or mixtures which have not been satisfactorily handled by pumps of conventional construction. In this construction, pumping rate is controlled by instrument air pressure responsive to variable flow, pH, temperature, liquid level, pressure, or any other instrument-measurable processing variable. And now, new improved Auto-Pneumatic instrumentation provides for greater capacity and/or pressure—full ratings as listed for manually-controlled models.

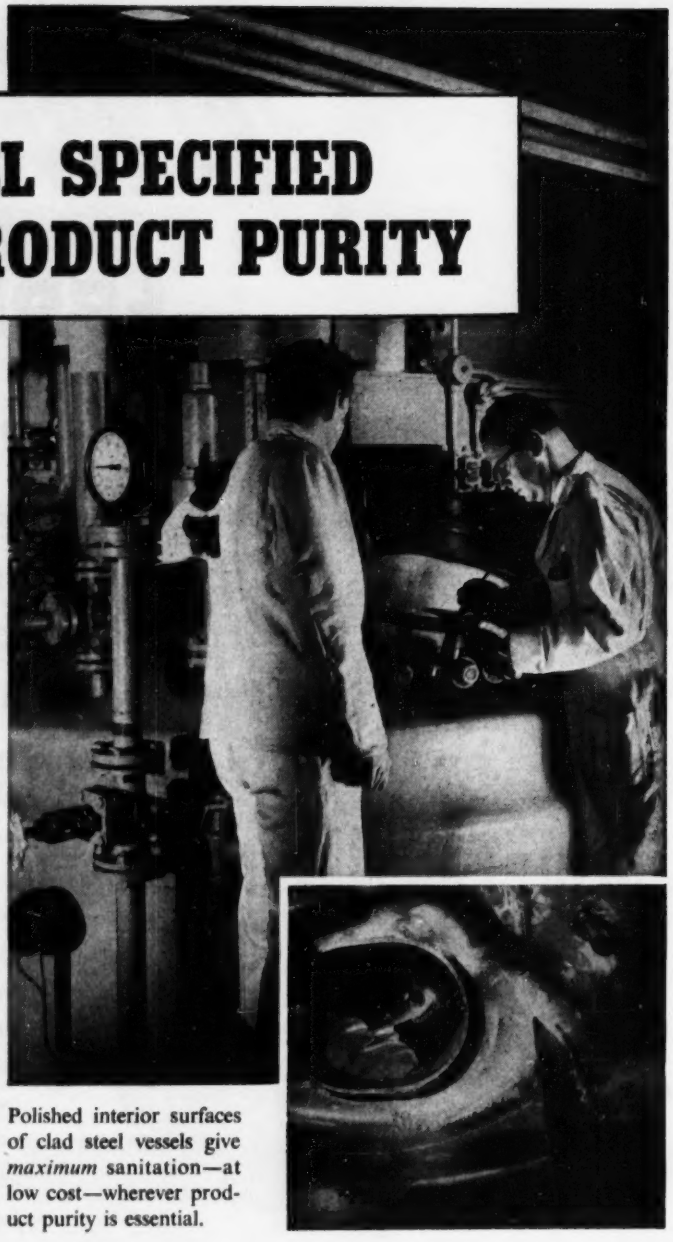


TWO PUMPS IN ONE!

Lapp Pulsafeeder is the combination piston-diaphragm pump for controlled-volume pumping of fluids. Reciprocating piston action provides positive displacement. But the piston pumps only an hydraulic medium, working against a diaphragm. A floating, balanced partition, the diaphragm isolates chemical being pumped from working pump parts—eliminates need for stuffing box or running seal. Constant pumping speed; variable flow results from variation in piston-stroke length—controlled by hand-wheel, or, in Auto-Pneumatic models, by instrument air pressure responding to any instrument-measurable processing variable.

***WRITE FOR BULLETIN 300** with typical applications, flow charts, description and specifications of models of various capacities and constructions. Inquiry Data Sheet included from which we can make specific engineering recommendation for your processing requirement. Write Lapp Insulator Co., Inc., Process Equipment Div., 115 Wilson St., Le Roy, N.Y.*

CLAD STEEL SPECIFIED TO GUARD PRODUCT PURITY



Even submicroscopic quantities of foreign bacteria or metallic pick-up are taboo in this antibiotics plant. To safeguard purity *economically*, stainless-clad steel was specified for the 5,000 gallon fermenter, as well as for intermediate fermenters, filter cake receivers and adjustment tanks.

Stainless-clad steel—a layer of solid stainless permanently bonded over its entire surface to a low-cost carbon-steel backing plate—does the work of costly solid stainless plate at considerable savings: polished interior surfaces protect product purity, guard against contamination, are quick and easy to clean . . . completely sanitary. Carbon-steel exteriors are economically painted, too, to help increase plant cleanliness and maintain an attractive appearance.

Whatever demands your processes place on tanks and pressure vessels—product purity, resistance to corrosion, high heat transfer—you'll find clad steel equipment means low first cost and long life. When you're planning new units, call your equipment builder in early. He can give you cost-saving suggestions, help your engineers design equipment to fit your particular needs.

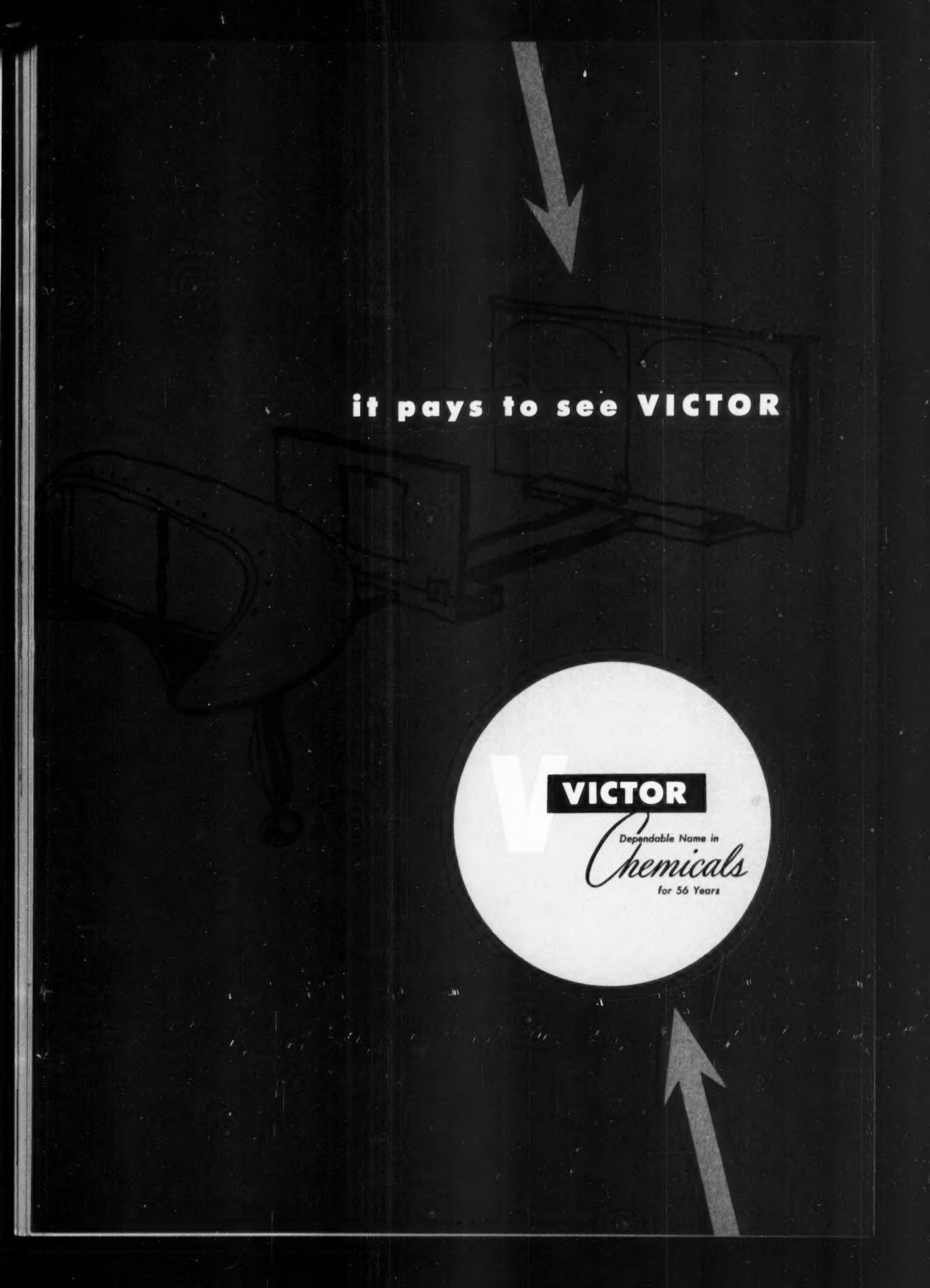
Polished interior surfaces of clad steel vessels give *maximum* sanitation—at low cost—wherever product purity is essential.

Ask one of your fabricators to show you the new Lukens clad steel movie, "Equip for New Profits." Here—in full color and sound—are factual accounts of how clad steel equipment brings new economies. The story can suggest new ideas to everyone concerned with production efficiency. Or contact Manager, Marketing Service, Lukens Steel Company, 678 Lukens Building, Coatesville, Pennsylvania.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

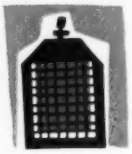
PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEELS AVAILABLE ANYWHERE


it pays to see VICTOR
VICTOR
Dependable Name in
Chemicals
for 56 Years

OXALIC ACID

Oxalic acid is a brilliant, transparent, colorless, crystalline material.

USES: Radiator cleaning compounds. Leather processing. Bleaching of straw, wood and cotton linters. Laundry sour for discharging bleach and removing iron stains. Washing coal. Removing rust stains from marble. Manufacture of metal polishes, blueprints, dyes, bluing. Purifying compound and precipitating agent. Analytical reagent. Reclaiming colored candles. Ink and rust remover. Purifying rosin. Cleaning railroad cars.



Remedy for Rusty Pipes

In automobile radiators, steel, hot water and air combine to produce rust and scale. Both are undesirable . . . particularly when they interfere with the cooling function of an automobile radiator. Nothing equals the ability of oxalic acid in keeping radiators clean and rust-free. Victor oxalic acid is one of the principal components of most nationally-known brands of auto radiator cleaners. It pays to see Victor.

SODIUM TRIPOLYPHOSPHATE

Sodium tripolyphosphate anhydrous, powdered or granular.

USES: Soap builder. Manufacture of detergents and water softeners. Purification of china clay. Conditioning oil drilling muds. Particularly effective in bar soaps; will not crystallize nor bloom. Disperses soap curds in hard water and eliminates scum. Clay dispersant. Deflocculant in raw cement slurries. Anti-pitch agent in paper making.

Wild Pitch Causes Loss

Paper making is a multi-million dollar industry in which phosphates play an important role. For example . . . Victor sodium tripolyphosphate and tetrasodium polyphosphate are used to remove wood tar or "pitch" from raw pulp that would cause "downgrading" if it were not taken out. In addition, Victor sodium phosphates are used to control water hardness. This prevents clogging of equipment and permits a better blending of water with pulp. Send for Technical Service Bulletin V1-52. It pays to see Victor.

DISODIUM PHOSPHATE, ANHYDROUS

Anhydrous disodium phosphate is a white, crystalline material of food grade purity. Also available, disodium phosphate duohydrate, a white, crystalline material which complies with Food and Drug Laws in purity.

USES: Boiler water treatment. Tin weighting of silk. Textile process waters. Buffer in dye-baths. Casein emulsifier. Processing of cheese. Manufacture of pharmaceuticals, and evaporated milk. Pumping pickle for canned meats.

Plug for Wisconsin

Children love it for lunch. Melted, it makes a tasty sandwich. Blended, it makes a splendid sauce. *It's delicious process cheese.* To give process cheese its smooth, creamy texture, cheesemakers call for Victor's disodium phosphate. Without it, process cheese would be crumbly and unappetizing in appearance. With it, process cheese sales have had a steady, healthy growth. It pays to see Victor.

FORMIC ACID

HCOOH

Formic acid is a fuming, colorless, corrosive liquid that evaporates completely on exposure to the air. It has a characteristic pungent, penetrating odor, and is milder than muriatic or sulphuric acid; considerably more active than acetic acid.

USES: Tanning. Acidifying dye-baths. Souring in laundries. Plating baths. Manufacturing formates, fumigants, insecticides, pharmaceuticals, antibiotics, refrigerants, solvents for perfumes, and lacquers. Wire stripping compounds.

Never Underestimate the Power of a Woman

By and large, men dye for women. The constant search for new colors and shades rests largely on the female fashion whim. Finding color variations is relatively simple. Matching these shades in various textiles and weaves is another story. Victor formic acid, diammonium phosphate, and other phosphates help dyers do their job faster, more accurately and with a minimum of risk. New applications for the textile industry are in the process of development. Write for details.

SURFACE-ACTIVE PHOSPHORUS COMPOUNDS

Victawet® 35B. Anionic. 70% paste. Soluble in water. Sparingly soluble in alcohol. Non-foaming.

Victawet® 58B. Anionic. 70% paste. Soluble in water. Sparingly soluble in alcohol. Used where clear water solution and small amounts of foam are desirable.

Victawet® 12. Non-ionic. 100% active liquid. Soluble in alcohols. Insoluble in naphtha. Milky solution in water. Non-foaming.

Victamines C & D.
(U. S. Pat. 2406423) Cationic. 100% active. Disperse in water. Soluble in alcohols, ether, kerosene, toluene.

Wetter Water Works Wonders

Reducing the surface tension of water increases the ability to penetrate, spread or "soak." In metal cleaning, for example, the use of a Victor wetting agent in the cleaning solution assures a more rapid, more thorough coverage of the surface to be cleaned. Faster cleaning and better cleaning often results. Many industries such as the textile, paper, detergent, laundry and chemical industries have found profitable use of such Victor wetting agents as Victawet 35B, 58B, 12 or Victamines C and D. It pays to see Victor.

ALUMINUM FORMATE

$Al(OOCH)_2OH$

Aluminum formate, basic (solution), U. S. Pat. 2154170, is a colorless solution containing 8.5% aluminum oxide (Al_2O_3), and mildly acid in reaction.

Specific gravity of 1.15–19° Baumé

USES: Waterproofing. Mordanting. Anti-perspirant compounds.

Solution for Stormy Weather

Ever wonder why a trench coat stays dry inside when it's raining "cats and dogs" outside? Victor aluminum formate provides part of the answer. Combined with waxes and other ingredients, aluminum formate makes a water-repellent coating for textiles and paper.

VICTOR

Dependable Name in Chemicals for 56 Years

PHOSPHORIC ACID

Phosphoric acid is a clear, colorless, sparkling liquid. All grades meet the requirements of the Federal and State Pure Food Laws.

Concentrations: 75%, 80%, 85% N.F.
115% (Polyphosphoric)

USES: Manufacture of yeast, sugar, soft drinks, imitation jellies, gelatin, and pharmaceuticals. Rustproofing, engraving, railroad car cleaning, refining oil and gasoline, preserving silage. Weighting silk, and dyeing textiles. Chemical polishing and electro-polishing metals, bright-dip baths for aluminum. Manufacture of phosphates, dental cements, glue, ceramics, glass, metal treating compounds, explosives, and fertilizers.

Start of a Beautiful Finish

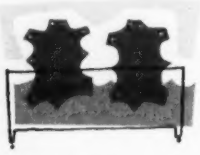
Victor phosphoric acid is giving many companies a brighter look on profits. Chemical or electro-polishing baths containing phosphoric acid are replacing mechanical buffing for the finishing of products made of stainless steel, aluminum and other metals which can be given a bright, shiny finish (inside and out) in a few minutes. Here is another example of how Victor helps industry find faster, lower cost or better production methods. It pays to see Victor.

SODIUM FORMATE

TRADE MARK — Protan®

Protan® sodium formate is a white, odorless powder, soluble in water.

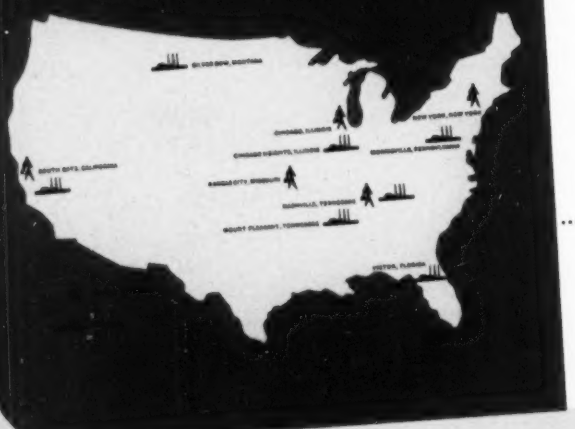
USES: Chrome tanning. Neutralization of leather. Wallpaper printing. Plating baths. Reducing agent. Blueprint developers. Neutralizer for carbonized wool.



Tanning Takes Time

Speeding tanning time interests every leather tanner. Victor sodium formate helps turn the trick. When sodium formate is added to chrome tanning solutions, the chrome liquors are stabilized, and rapid, uniform penetration of the leather takes place. Fixation is increased and more chrome is exhausted from the solution. In addition to other advantages, leather is produced with greater smoothness and fullness. Sodium formate is the most effective of the chrome tanning masking agents. Further proof that it pays to see Victor.

plants and offices of VICTOR CHEMICALS



it pays to see

VICTOR

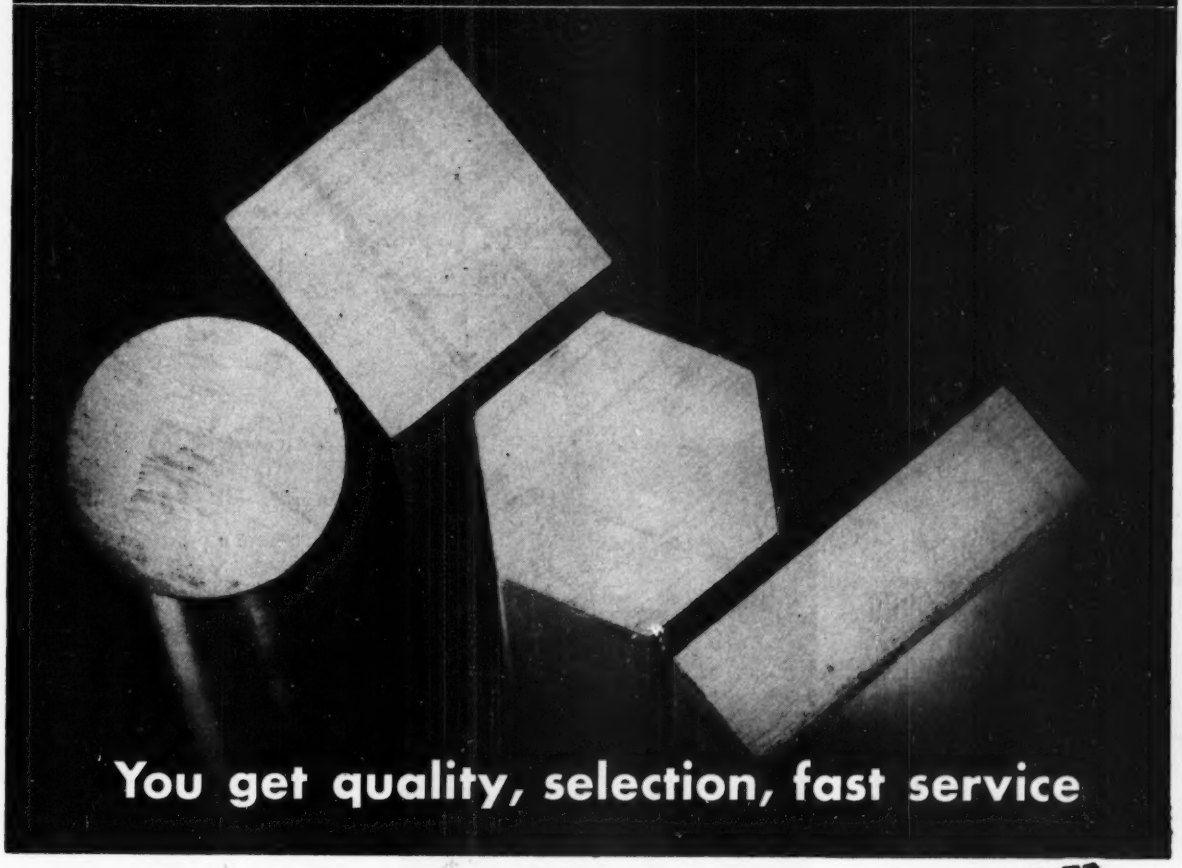
Dependable Name in Chemicals for 56 Years

VICTOR CHEMICAL WORKS

141 West Jackson Boulevard

Chicago 4, Illinois

WHY IT PAYS TO BUY COLD FINISHED BARS FROM US



You get quality, selection, fast service

You will save money buying your cold finished bars from U.S. Steel Supply. We carry complete stocks of all the shapes and sizes that are in common demand. All are manufactured from the world's leading quality steel—United States Steel. And we will work closely with you to select exactly the right quality for your requirements—and the right quality is *not* always the most expensive.

You needn't tie up money and space in large inventories of cold finished bars . . . we can quickly supply whatever you need. Call us for: cold finished rounds, squares, hexagons, flats and precision shafting in all grades; cold finished screw stock, Bessemer rounds, "MX" high speed screw stock.

TRIPLE SECURITY

What you want
When you want it
At the right price

U. S. STEEL SUPPLY
DIVISION

General Office
208 So. La Salle St., Chicago 4, Ill.

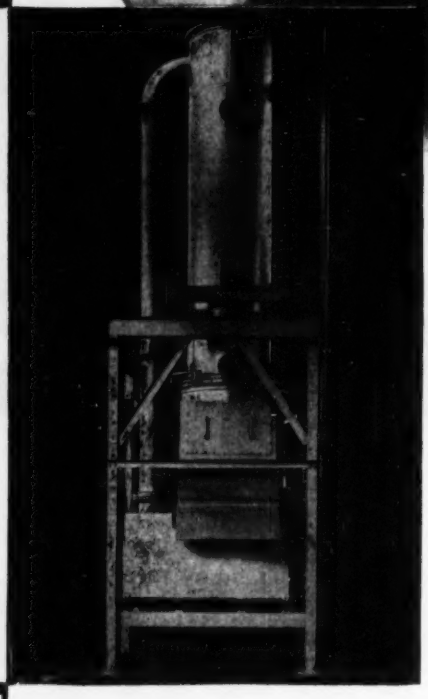
Warehouses and Sales Offices
Coast to Coast

USS STEEL
UNITED STATES STEEL

UNITED STATES STEEL

*this machine congeals, molds and discharges automatically

"What is your processing problem?"



***If your process involves a liquid that will solidify when cooled.... ....this machine can do it....then discharge and size the substance.... all automatically**

If you have a processing problem, perhaps the Vogt Automatic Tube-Type Molding Machine will provide the answer because it will form and size any liquid that will solidify when cooled, and will discharge by gravity upon heating.

Now in use by major chemical companies, these units have achieved tremendous savings in labor while producing a more uniform product. Also, since the process involves "freezing" or solidifying the substance while it circulates through tubes, the quality of the product is often superior to that of the original charge.

The wide range of uses to which Vogt Tube-Type Molding Machines have been adapted indicates their definite value in the chemical processing field. Adaptation possibilities are virtually unlimited and you may request detailed technical information from our engineers without obligation.

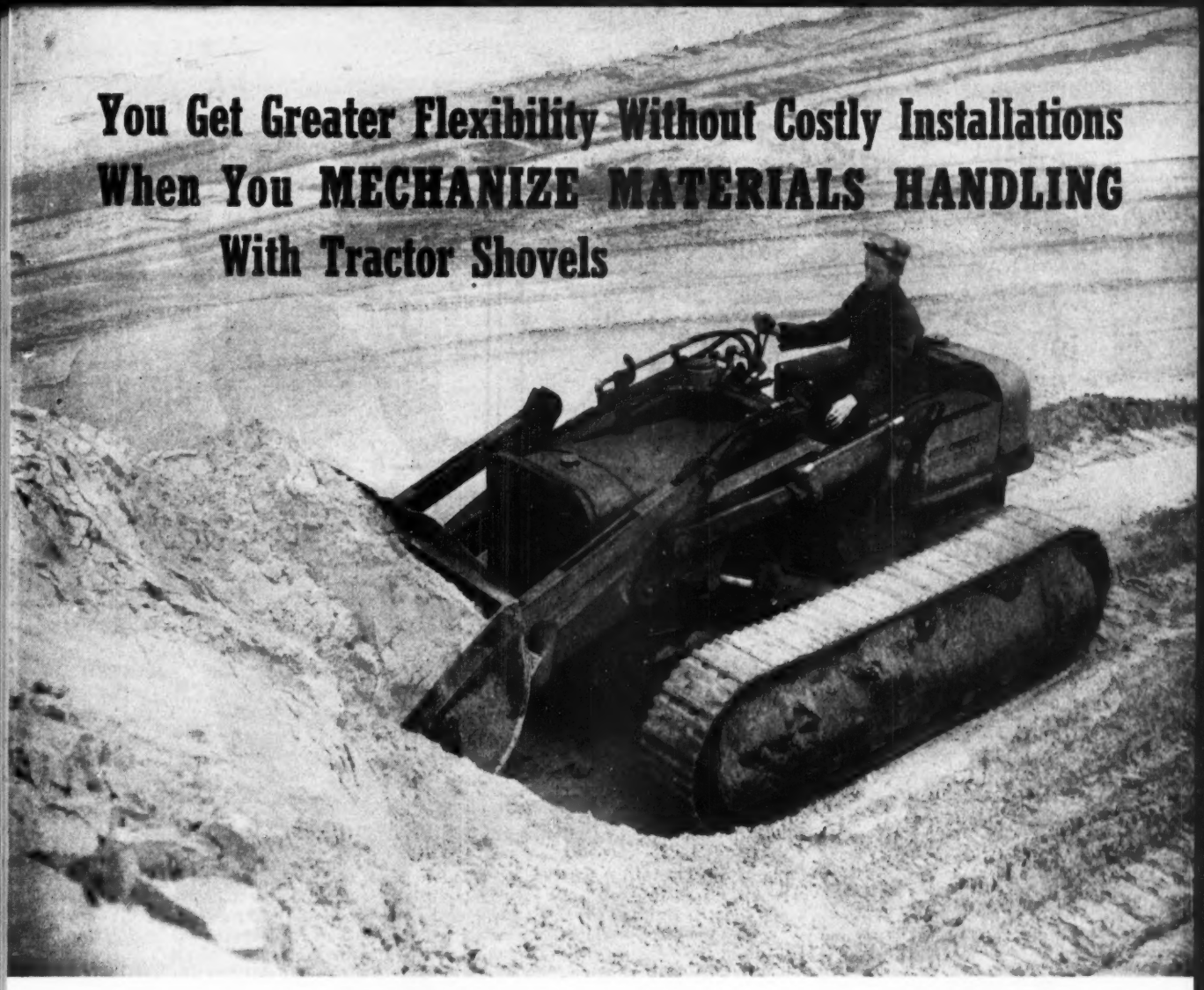
Vogt Automatic Tube-Type

MOLDING MACHINE

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

You Get Greater Flexibility Without Costly Installations When You MECHANIZE MATERIALS HANDLING With Tractor Shovels



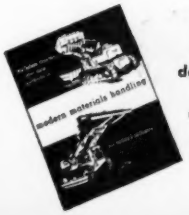
When you put an Allis-Chalmers Tractor Shovel to work around your plant, it starts paying its way immediately. There is no down time for installation or costly plant alteration . . . no long training course for the operator. What's more, this one-operator machine not only saves many man hours, it gives you the benefit of several specialized units in one.

As Materials Handlers, Allis-Chalmers Tractor Shovels, with capacities from one to four cubic yards, pick up and carry all types of bulk, solid or packaged loads and deliver them anywhere in or around the plant. Storage areas may be changed at will. Special attachments — Lift Forks, Rock Forks, Bulldozers and Angledozers plus many others for some models — may be interchanged with the bucket in about 20 minutes.

As Prime Movers, these powerful crawler tractors can pull, lift or skid heavy machinery, spot railroad cars at loading docks. Traction and flotation enable these machines to work in snow or mud where wheel-mounted equipment bogs down.

As Maintenance and Construction Machines, Allis-Chalmers Tractor Shovels handle general clean-up work around the plant, build plant roads, excavate for new construction, clear snow . . . keep busy repaying your investment winter and summer.

Ask your Allis-Chalmers dealer to show you how the versatile Tractor Shovel is helping cut costs for thousands of owners. There are four sizes to fit your needs from the one-yard HD-5G to the four-yard HD-20G with torque converter drive.



Write for catalog describing the use of tractors in modern materials handling.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

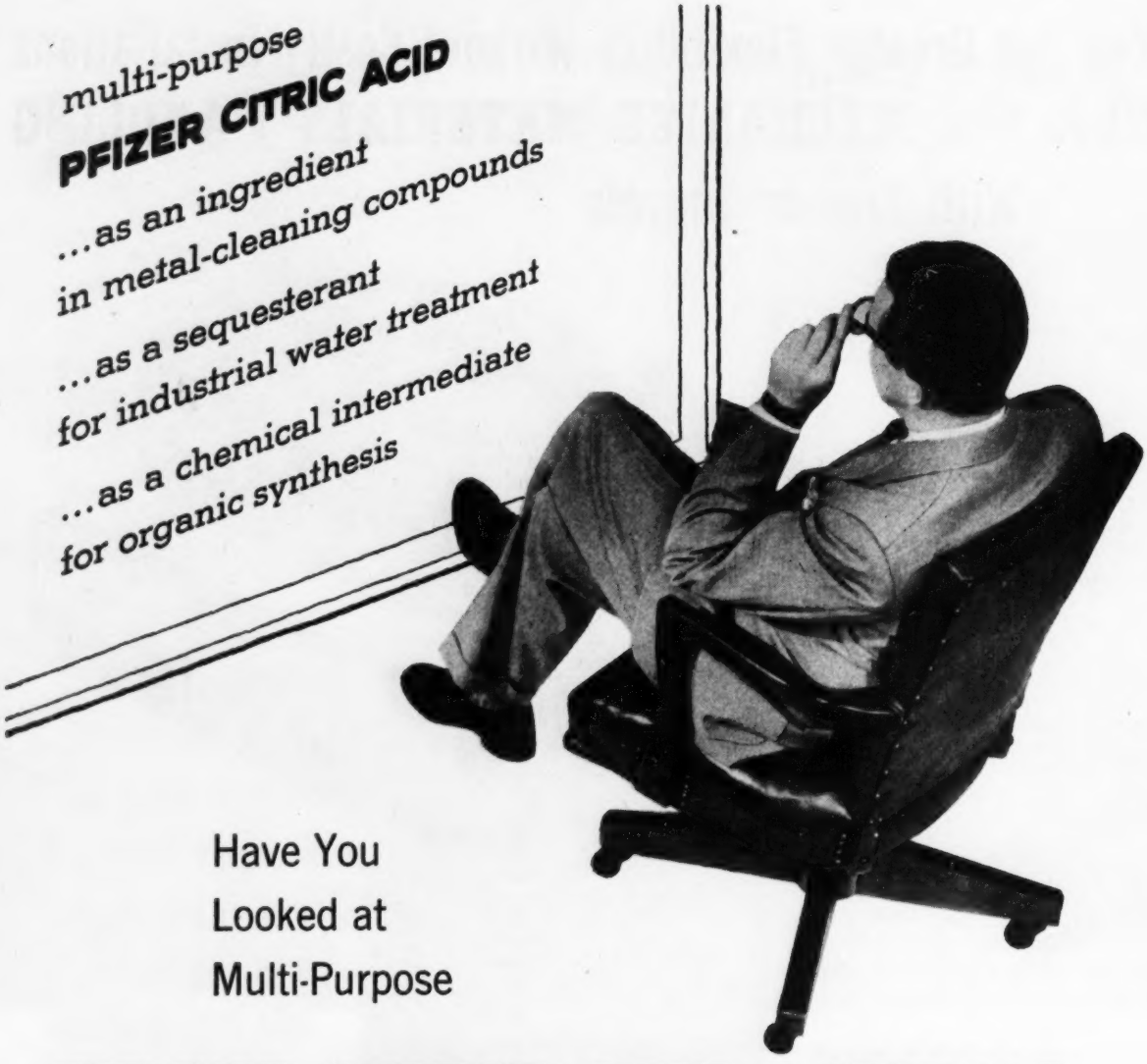
multi-purpose

PFIZER CITRIC ACID

...as an ingredient in metal-cleaning compounds

...as a sequesterant for industrial water treatment

...as a chemical intermediate for organic synthesis



Have You Looked at Multi-Purpose

PFIZER CITRIC ACID LATELY?

• Time-tested, non-toxic Pfizer Citric Acid serves industry in a wide variety of ways. In metal finishing, for example, Citric removes scale and oxide films. One of its salts, Di-Ammonium Citrate, removes iron contamination from stainless steel and rust scale from iron surfaces.

Since it forms water soluble complexes with metallic ions such as iron and calcium, Pfizer Citric Acid makes an ideal sequestering agent to keep metals from precipitating out of solution. As a sequesterant, it is used in industrial water treatment, edible oil production, 2, 4-D formulations and manufacturing processes.

Its chemical structure (one hydroxyl and three carboxyl groups) makes Citric Acid an interesting intermediate for organic synthesis. Esters of Citric Acid, several of them marketed by Pfizer, offer the plastics industry plasticizers with an extremely low order of toxicity for a wide range of uses.

These many and varied applications may suggest Pfizer Citric as an acid or intermediate in your processing. Take a new look at it today!

CHEMICAL PROGRESS WEEK-MAY 1954

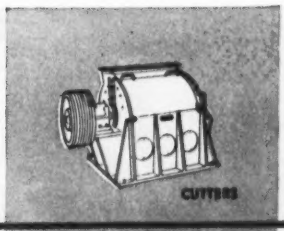
CHAS. PFIZER & CO., INC.

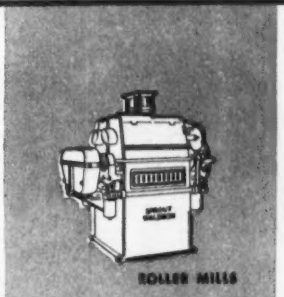
630 Flushing Ave., Brooklyn 6, N. Y.
Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.

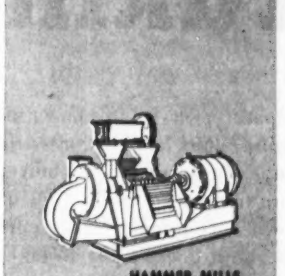
Manufacturing Chemists for Over 100 Years

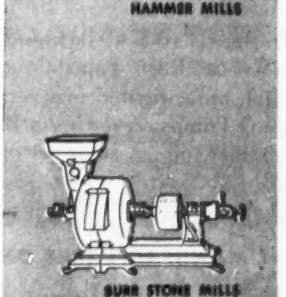
Pfizer

what's the **ONE BEST** answer to your problem of...









...GRANULATING?

A rotary knife cutter is probably your *one best* answer to granulating problems. It usually produces particles of more uniform size than are obtainable through any other type of machine. On the other hand, Sprout-Waldron has sometimes used roller mills with proper combinations of roll corrugations and speed differentials for this task. The attrition mill often offers the most flexible and economical means of granulating because disc surface, speed of rotation, clearance between surfaces, and feed rate can be varied. And a crusher might be the answer if the material is somewhat friable and the end-product size justifies it.

The nature of the material and the end product desired determine the proper machine to use with the least possible cost. Perhaps in no other operation is experience so important. The control of particle size in a finished ground product and the holding of extreme fines to a minimum are fields in which Sprout-Waldron has had unlimited experience.

...DEFIBERIZING?

Pulling rags apart into threads or ragged swatches, flocking sheet pulp, pulping wood chips, shredding leather, defiberizing old rubber tires, shredding jute—to name only a few widely scattered operations that can be classified as involving a defiberizing action—are applications on which Sprout-Waldron engineers and Sprout-Waldron products can combine to give you the *one best* answer. Each case must be investigated as to material and end results desired. And from such an investigation will come a recommendation that very conceivably can put you far ahead of your competition.

...PULVERIZING?

For many operations classified as pulverizing, Sprout-Waldron can supply the *one best* answer from a vast line of size reduction equipment. And if Sprout-Waldron doesn't have your *one best* answer, you'll be told who does have it.

For some pulverizing, hammer mills are often the answer, and Sprout-Waldron has an interesting and unique line of units that have solved many different processing problems by proper selection of hammers and screens. Many times attrition mills or roller mills furnish the *one best* answer, and where a fine, floury texture is particularly important, burr stone mills can sometimes be the solution.

Each size reduction problem has a solution that is the one best answer and that can be determined by submitting the problem to Sprout-Waldron. You will receive a recommendation based on the combined experience of men working constantly with size reduction problems and backed by successful case history files of processing solutions, and laboratory processing test data. If Sprout-Waldron equipment does not meet your needs, you'll be directed to a manufacturer who can supply the one best answer. Let Sprout-Waldron study your size reduction problems without cost or obligation.

SPROUT-WALDRON

Manufacturing Engineers Since 1866

Equipment for SIZE REDUCTION · MIXING & BLENDING · PELLETING & CUBING · BULK MATERIALS HANDLING · PRODUCT CLASSIFICATION

Facilities for fabricating, machining, custom founding, woodworking, laboratory testing

15 LOGAN STREET • MUNCY, PA.

927

Taking No Chances

Evaporator service in a paper mill, like most liquid handling jobs in the process industries, demands pumps of proved dependability. "Time out" for a pump frequently means time out for a great deal of other equipment representing heavy investment, so it doesn't pay to take chances.

This installation at Jacksonville, Florida, in the plant of St. Regis Paper Company, is a typical example of far-sighted engineering. These LaBour Type Q Pumps serve Goslin-Birmingham evaporators, and you can safely bet that interruptions to service due to pump maintenance or repair are going to be few and far between. As far back as 1927 LaBour was able to advertise pumps that "never lay down on the job", and has been truthfully able to say the same thing ever since.

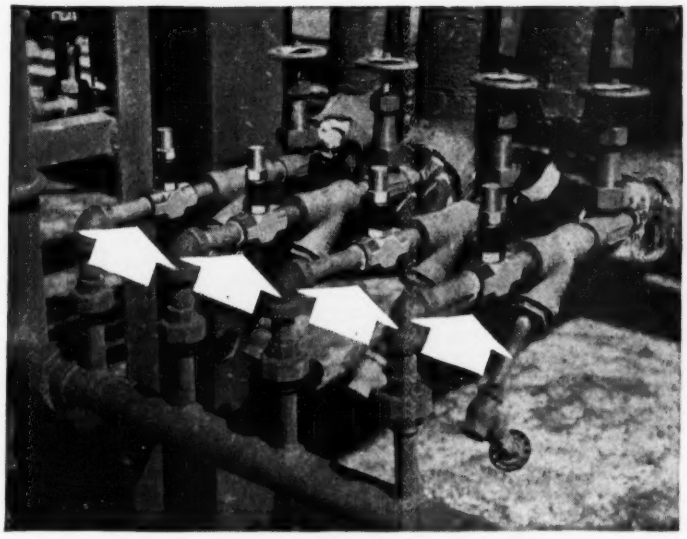
Old-timers in chemical engineering know the LaBour reputation for dependability, but the smart youngsters in the profession have taken the trouble to learn *why* LaBour pumps stand up so well. There's no mystery about it—the reasons are clear. We'll be glad to explain at your request.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.

3000 impulses help keep mid-west refinery "on stream"



THIS big refinery at Lawrenceville, Ill.—like a lot of other important refineries — uses Yarway Impulse Steam Traps.

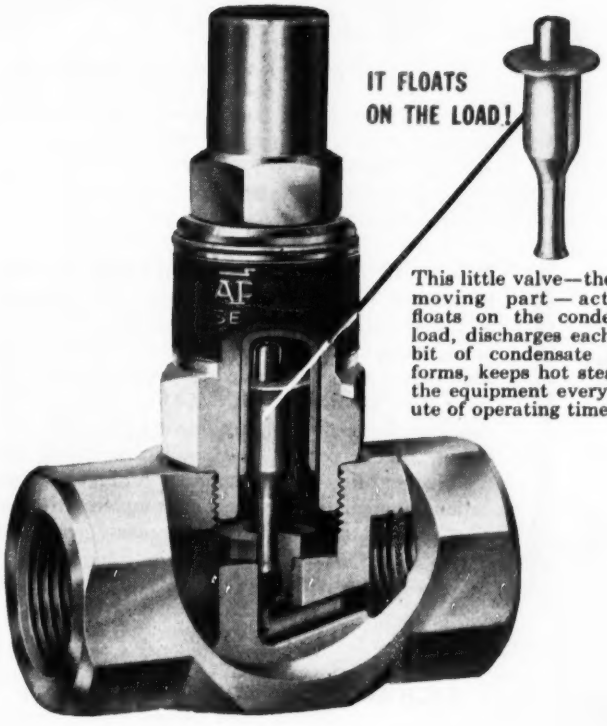
Over 3000 Yarway Impulse Traps are installed on tracer lines and for draining steam headers.

Popular features of the Yarway Impulse Steam Trap are its ability to get equipment *hot in a hurry*—and keep it hot! . . . also its small, handy size—fits in easily in any location; its stainless steel body and working parts; quick installation; easy maintenance; low initial cost.

Another advantage—IMMEDIATE DELIVERY from 250 local distributors, plus quick service from nearby Yarway field engineers.

More than 900,000 Yarway Impulse Steam Traps have been sold. For a free Steam Trap Selector, write . . .

YARNALL-WARING COMPANY
137 Mermaid Ave., Philadelphia 18, Pa.

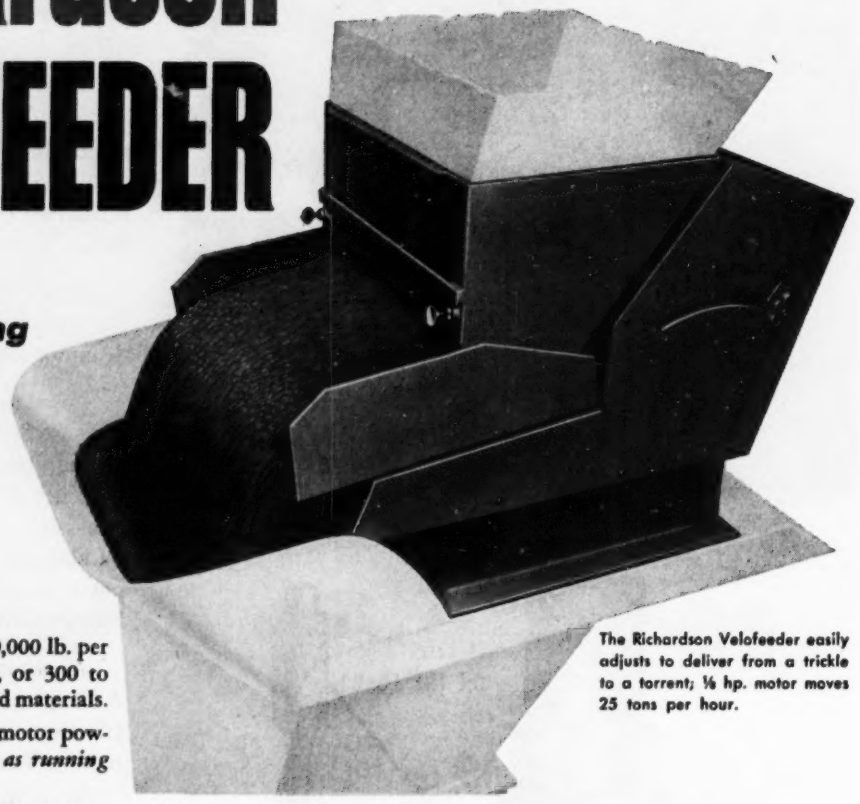


This little valve—the only moving part—actually floats on the condensate load, discharges each tiny bit of condensate as it forms, keeps hot steam in the equipment every minute of operating time.

YARWAY impulse® steam trap

The NEW Richardson VELOFEEDER

means Better Bulk Feeding for the Chemical Process Industries



The Richardson Velofeeder easily adjusts to deliver from a trickle to a torrent; ⅛ hp. motor moves 25 tons per hour.

HERE'S WHY—

Higher Output—from 300 to 50,000 lb. per hr. of hard granular materials, or 300 to 30,000 lb. per hour of soft ground materials.

Lower Power Needs—a ⅛ hp. motor powers entire unit—*as inexpensive as running a 100-watt light bulb!*

Smaller Space Needs—only 35 inches long, 17½ inches wide, 19 inches high. Standard vibrating tray 16 inches wide—stainless steel when required.

Easier Control—simple, quick adjustment, over wide operating range (from near 0 to 50 fpm. maximum).

Safer Operation—motor is explosion-proof (Class 2, Group G) where hazardous dust conditions exist. Complete dust enclosure on special application.

Less Vibration—although working frequency is 1850 vibrations per minute, little or no vibration is transmitted to any mounting installation (mounts with only 4 bolts!).

Now widely introduced for the first time, the new Richardson Velofeeder is a vibrating feeder offering *all* the advantages outlined. It is mechanical in operation, requiring negligible power to deliver a very high output rate, unequalled for total efficiency. Of more than 300 now in use, none has failed. Ideally suited to the feeding of free-flowing chemicals, fertilizer, rubber pellets, and similar materials, the Velofeeder offers a wide range of profitable application. Immediate delivery. For complete information on this new development, please write for Data Sheet 5302.

Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

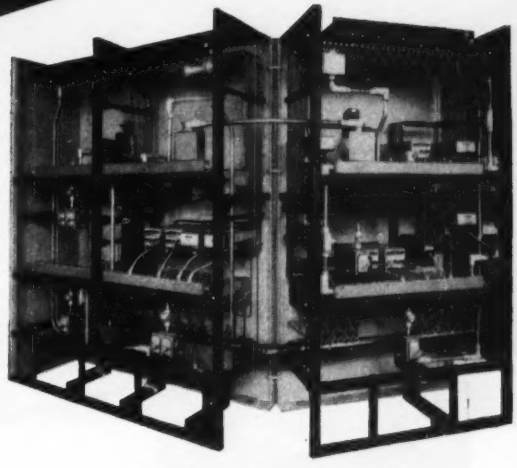
RICHARDSON SCALE COMPANY
Clifton, New Jersey

Atlanta • Boston • Buffalo • Chicago • Detroit • Houston
Minneapolis • New York • Omaha • Philadelphia
Pittsburgh • San Francisco • Wichita • Montreal • Toronto

Creative Contributions to Centralized Process Control...

GRAPHIC PANELS

by FOXBORO



Typical back-of-panel view. Note open framework construction (easily enclosed if desired), terminals tagged for quick identification in field, neat arrangement of tubing and wiring, full accessibility to all instruments.

Years of experience in panel design and construction have equipped Foxboro Panel Engineers with many exclusive techniques . . . methods which bring you unequalled performance in centralized process control.

One typical feature is the use of aluminum strips and shapes, three-dimensional in effect, in bright, permanent colors, to symbolize flow lines and vessels. These are securely attached over the background finish, yet may readily be rearranged when necessary without marring the finish or leaving ugly holes. (If you prefer, painted graphic panels can be furnished.)

Behind the panel, Foxboro's open framework construction and the neat, clean arrangement of piping and wiring permit quick installation and far easier maintenance.

Foxboro's skilled Panel Assembly Department completes the team which provides you with the most efficient and usable Graphic Panels available today. Let us work up a detailed proposal for you.

The Foxboro Company,
365 Neponset Ave.,
Foxboro, Mass.

FOXBORO
Reg. U. S. Pat. Off.

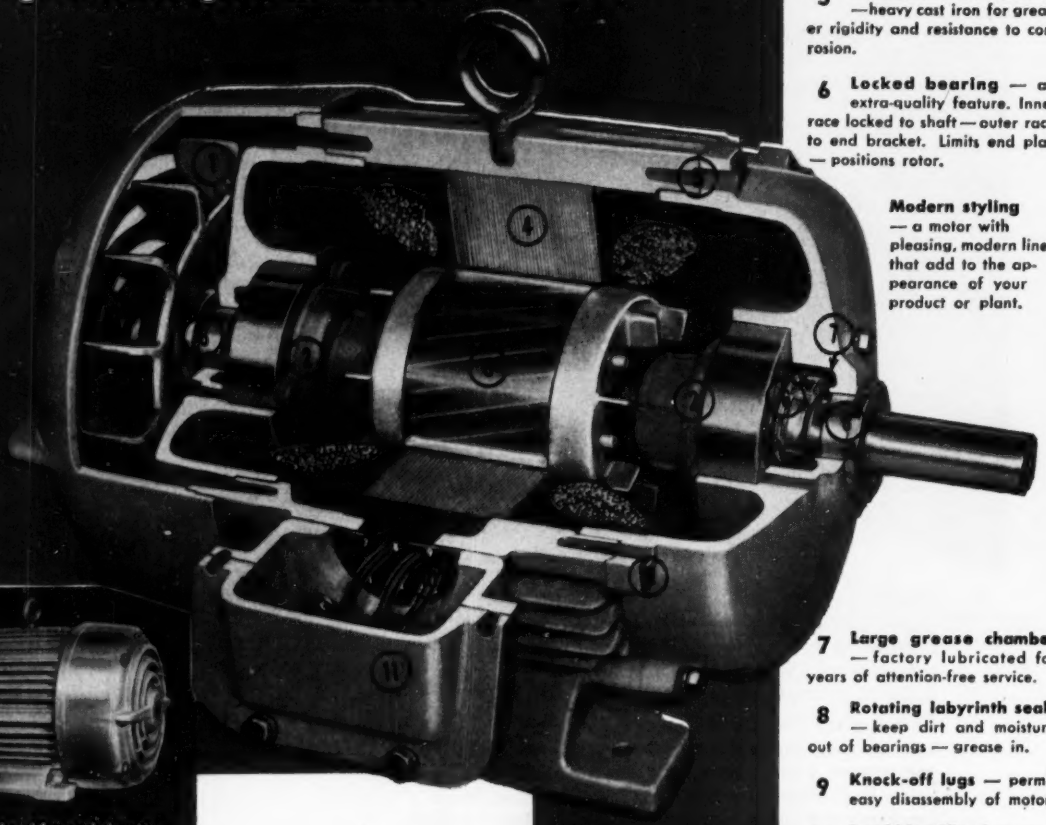
PROCESS CONTROL ENGINEERING

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

Here's the inside story of

the NEW L.A. *Line*

...your BEST enclosed and explosion-proof motor BUY



1 Fan — efficient, non-sparking fan. New aerodynamic design for more effective cooling.

2 Inner bearing cartridges — lock bearings to end bracket and form explosion-quenching seal along shaft.

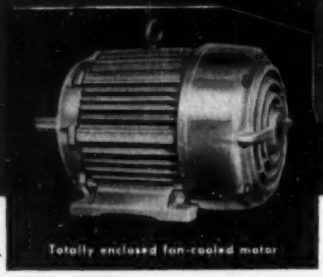
3 Indestructable cast-aluminum rotor—dynamically balanced with fan for smooth, quiet operation.

4 Stator — prewound stator core utilizes Formvar wire insulated with a new Alkyd Asphalt Resin insulating varnish.

5 End bracket and housing —heavy cast iron for greater rigidity and resistance to corrosion.

6 Locked bearing — an extra-quality feature. Inner race locked to shaft—outer race to end bracket. Limits end play — positions rotor.

Modern styling — a motor with pleasing, modern lines that add to the appearance of your product or plant.



Totally enclosed fan-cooled motor

7 Large grease chamber — factory lubricated for years of attention-free service.

8 Rotating labyrinth seals — keep dirt and moisture out of bearings — grease in.

9 Knock-off lugs — permit easy disassembly of motor.

10 Lead identification—permanent, positive lead identification spacer in conduit box.

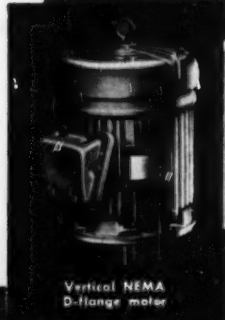
11 New split conduit box — rugged cast-iron conduit box diagonally split for easy connection.

This is the completely new L.A. totally enclosed fan-cooled and explosion-proof motor. Every feature in this new line is designed for easier installation, longer service life, less maintenance and attention. You get the full benefit of the new NEMA standards in a smaller, more functional, completely modern design.

Your nearby Louis Allis Sales Engineer can show you all the reasons why these motors perform better and longer on your tough jobs — why they give you maximum resistance to corrosion wherever you need this extra protection. Call him today.

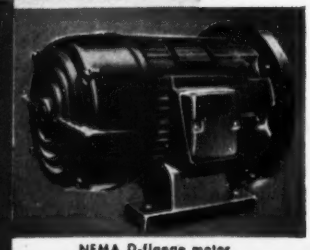
THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

LA-103



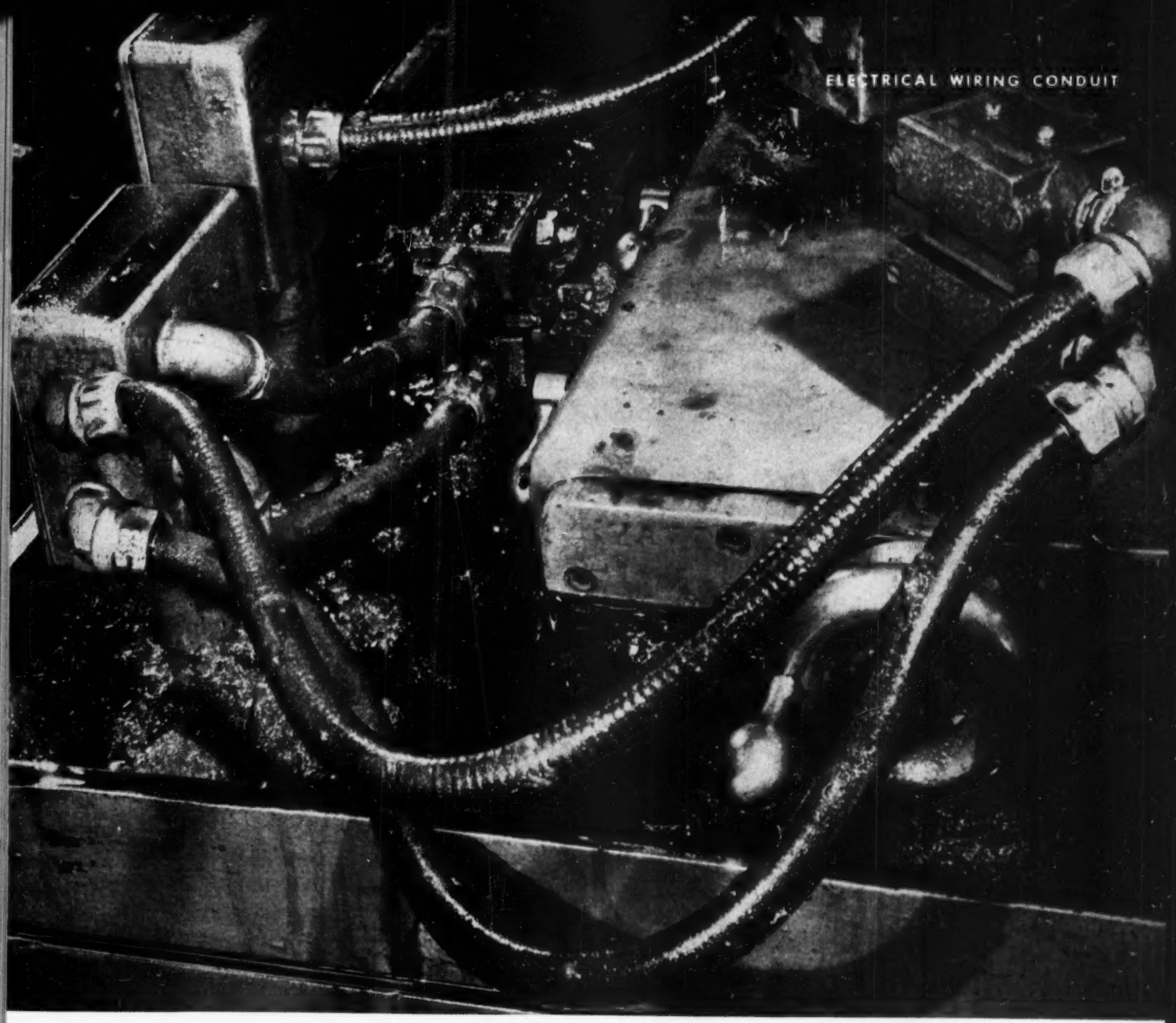
Vertical NEMA D-flange motor

NEMA C-flange motor



NEMA D-flange motor

We specialize in SPECIAL MOTORS— *and* PROMPT DELIVERY, TOO



PRODUCTION GRINDER IS TOUGH TEST for wiring conduit. SEALTITE passes easily... protects against grinder dust, oil, coolant, and movement.

Tough synthetic cover on this conduit keeps these control wires working

IT'S SEALTITE* ELECTRICAL WIRING CONDUIT . . . PROTECTION AGAINST ENEMIES OF WIRING

SEALTITE was made to handle trouble. Oil and grease. Weather, water and dirt. Chemicals, corrosive fumes and salt spray. None gets by SEALTITE's synthetic jacket. Wiring can't be damaged. Protection is complete.

But SEALTITE offers more than just toughness. It is light and flexible. It installs easily in cramped spaces. It absorbs vibration—takes movement. And it hugs motor contours . . . looks neat.

Liquid-tight SEALTITE is the first conduit of its type to be approved by Underwriters' Laboratories, Inc. for use where exposed to moisture and mineral oils. (See N.E. Code, Art. 351.) For tight bends on machine tools and industrial equipment, use SEALTITE Type EF (Extra Flexible). It meets standards set by J.I.C.

Electrical wholesalers stock both types in coils. Buy it this way; then cut without waste. Wholesalers also stock standard liquid-tight fittings for use with SEALTITE.

*Trademark 54178

SEALTITE

flexible, liquid-tight electrical conduit
an ANACONDA® product

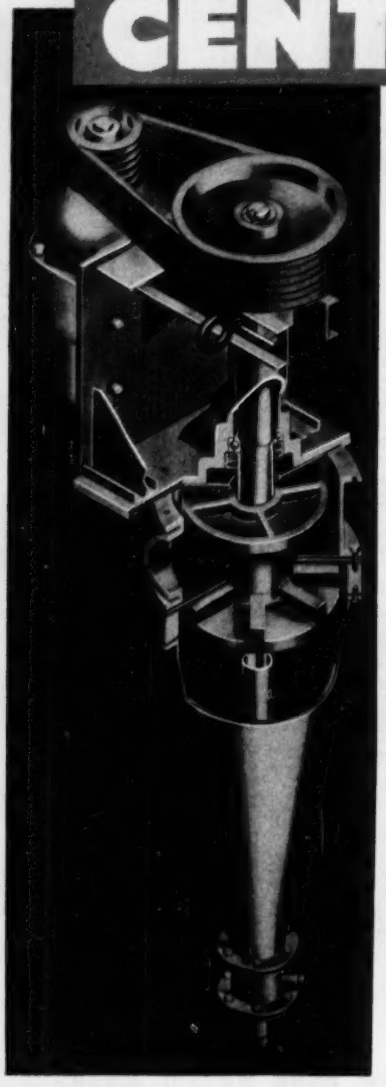
The American Brass Co., American Metal Hose Branch, Waterbury 20, Conn.
Please send me descriptive booklets on SEALTITE Electrical Wiring Conduit.

NAME.....
PLEASE PRINT
COMPANY.....
STREET.....
CITY..... ZONE..... STATE.....

FOR
MICRO-SIZING
DESLIMING
DESANDING
CLASSIFYING
DEWATERING
THICKENING

Check these Operating Values in the

CENTRICLONE*



Combines the Action of the Conventional Liquid Cyclone and the Centrifuge

- ✓ Separates fines from coarse, or particles of different specific gravity, in liquid suspension with size separation down to 10 microns.
- ✓ Separations can be effected at very high slurry densities, thereby avoiding undesirable dilution; several Centriclones are working on feeds with 64% solids.
- ✓ Very high capacity which, coupled with design, minimizes floor space when set up either vertical or horizontal.
- ✓ High speed internal impeller, rather than high feed pressure through tangential orifice inlet, induces high circulating velocity and greater centrifugal force with economical power input.
- ✓ All parts subject to wear accessible for easy replacement.

The Centriclone, taken over by us in 1952 and further developed by our design engineers, often fits into the filtration picture as a feed conditioner which is one reason why we acquired it. But it has many other applications, as noted above. We'll be glad to discuss it with you if on further study you feel the Centriclone has any application at all in your flowsheet. And, of course, we'll also be happy to take care of your filtration problems, too.

Send for our Bulletin No. 800 which fully describes the CENTRICLONE

*Trade Mark

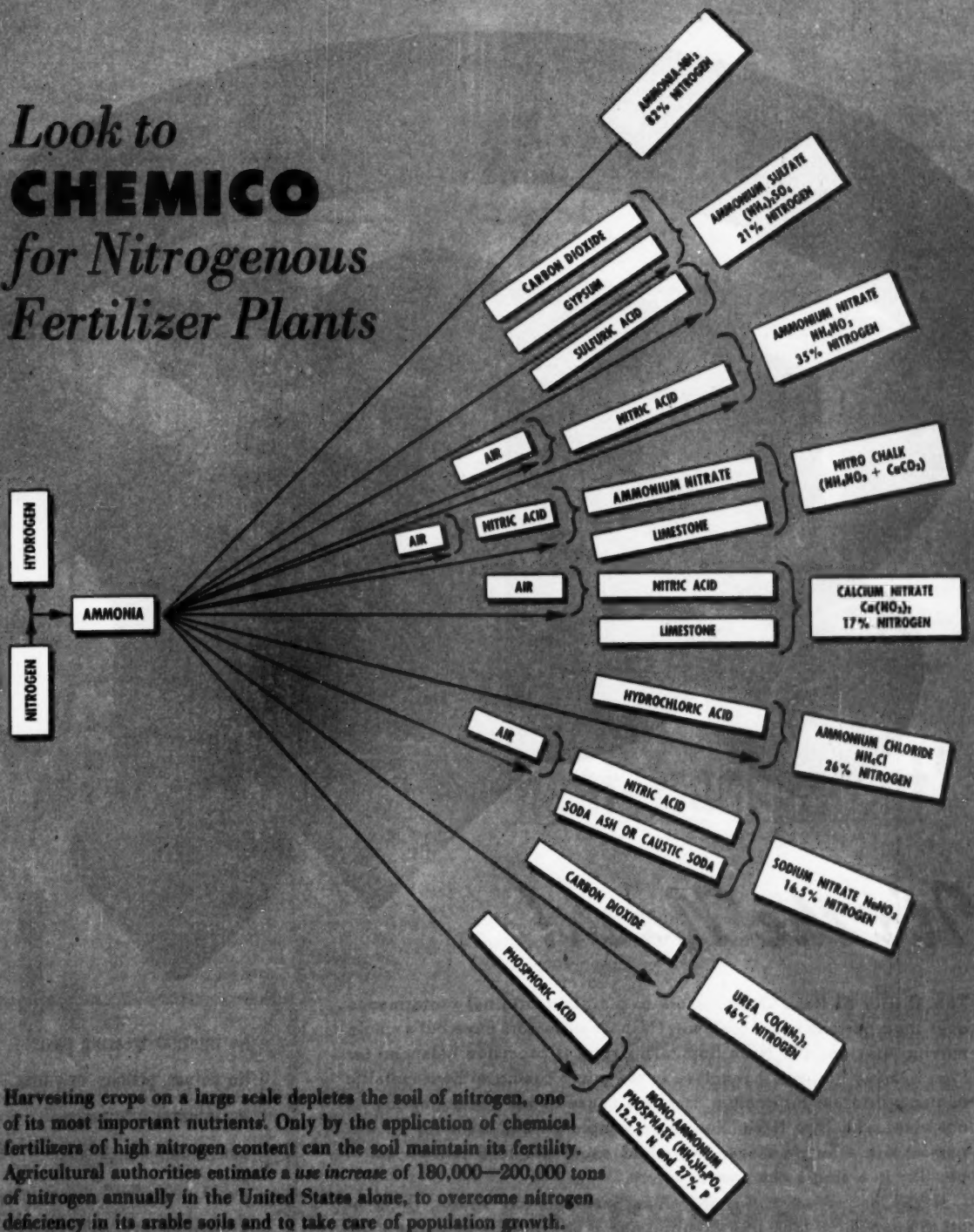
WORLD WIDE SALES, SERVICE AND MANUFACTURING FACILITIES

OLIVER UNITED FILTERS INC.

NEW YORK 36 — 33 West 42nd Street • CHICAGO 1 — 221 North LaSalle Street
OAKLAND 1 — 2900 Glascock Street • SAN FRANCISCO 11 — 260 California Street
Export Sales Office — New York • Cable — OLIUNIFILT

FACTORIES:
Hazleton, Pa.
Oakland, Calif.

Look to **CHEMICO** *for Nitrogenous Fertilizer Plants*



Harvesting crops on a large scale depletes the soil of nitrogen, one of its most important nutrients. Only by the application of chemical fertilizers of high nitrogen content can the soil maintain its fertility. Agricultural authorities estimate a *use increase* of 180,000—200,000 tons of nitrogen annually in the United States alone, to overcome nitrogen deficiency in its arable soils and to take care of population growth.

The Chemico organization is specially qualified to design and construct plants for the production of ammonia and nitrogenous fertilizers of all types. It offers a world-wide service backed by 40 years of experience.

NOTE: Formulas and percentages are on a theoretical basis. Fertilizers are produced in various grades.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

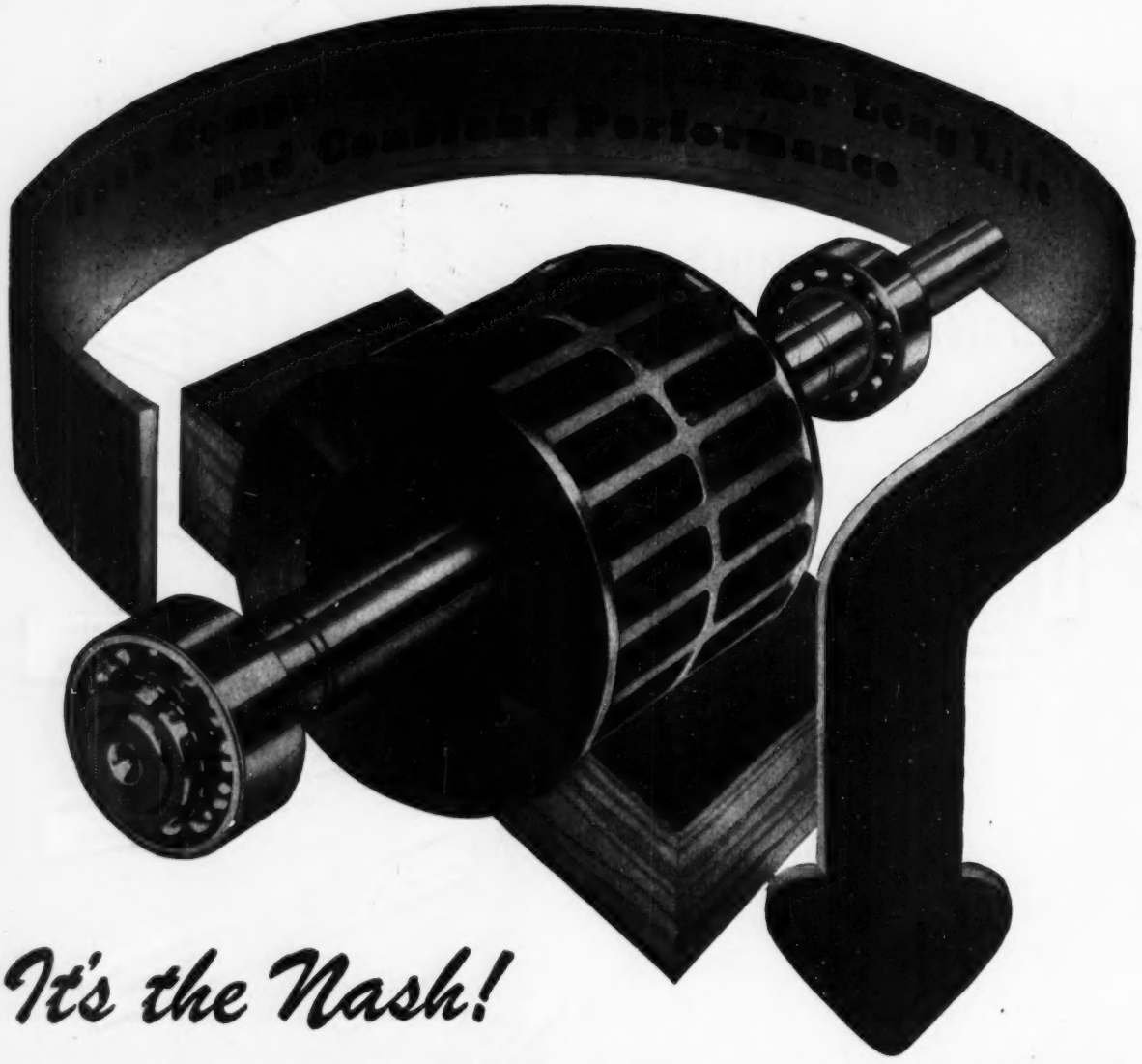
488 MADISON AVENUE, NEW YORK 22, N. Y.

CABLES: CHEMICONST, NEW YORK

TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICAN CYANAMID (PTY) LTD., JOHANNESBURG

CC-254

Chemico plants are profitable investments



It's the Nash!

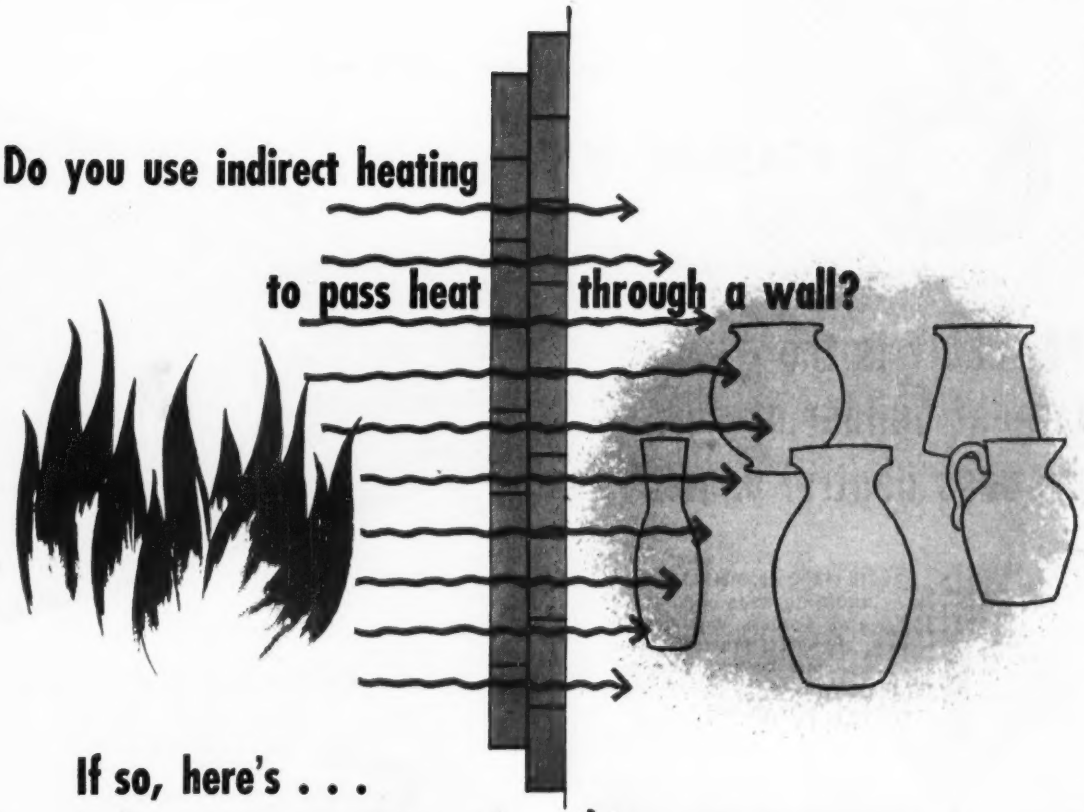
The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors *are* compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature Automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.



If so, here's . . .

A refractory that's "heat-transparent"

This is how three commonly used refractories compare in thermal conductivity, (BTU/hr, sq ft and °F/in. of thickness at 2200 F). From left to right: silicon carbide, aluminum oxide, and fireclay.

While you ordinarily think of a refractory as a heat-*containing* material, CARBORUNDUM's silicon carbide is anything but. It actually transmits heat *11 times faster* than fireclay. Practically as fast as the high temperature alloys!

This property is silicon carbide's greatest asset. It makes it ideal for retorts, muffles, and hearths . . . or wherever you pass heat through a wall. Take one case: When used to replace the fireclay arch of a Mannhiem furnace, output was doubled—and the fuel input ratio was cut 50%! And that's not an exaggerated example.

This same property enables silicon carbide to absorb and release *up to five times as many BTU's* per second as fireclay. It's ideal for checkers, recuperators, and other heat-exchange equipment. On the other hand, it's equally good where heat has to be dissipated (e.g. arc shields, pot settings, etc.)

But the clinching advantages are that it has a tested crushing strength of over 10,000 psi at 2500 F . . . is safe to use up to 3000 F . . . withstands abrasive/erosive wear-and-tear far better than metals . . . is inert to acid attack . . . and, in general, outlasts other materials, even under the most destructive conditions known.

In fact, this ability to withstand extreme conditions distinguishes *all* CARBORUNDUM's super refractories (including one of the best *insulating* materials for high temperature work). These range all the way from a cotton-like ceramic fiber to super-dense refractories that are cast like metals. So whether you need to conduct heat, or contain it, CARBORUNDUM's "man-made minerals" offer unusual possibilities. We'd like to explore their interesting features with you.

CARBORUNDUM

Registered Trade Mark

Dept. Y-44, Refractories Division
The Carborundum Co., Perth Amboy, N. J.

☐ As a starter, send literature only.
☐ I'd like first-hand information. Please phone for appointment.

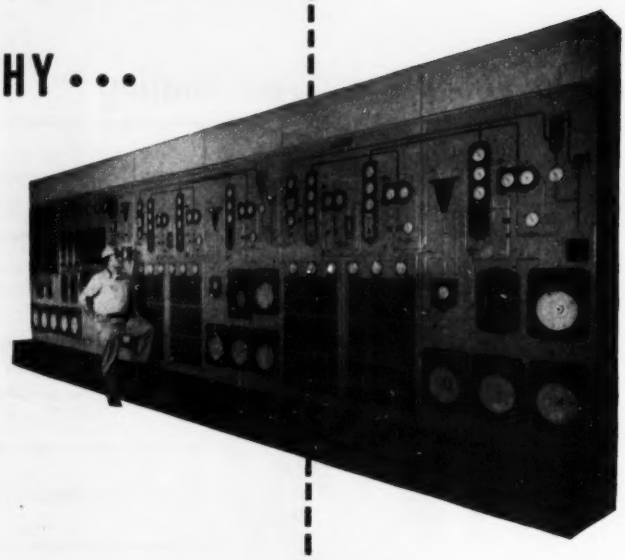
Name_____ Position_____

Company_____

Address_____

6 REASONS WHY...

PANELLIT is the largest builder of process control panels



1 **SPECIALIZED ENGINEERING . .** combining instrumentation and process experience, PANELLIT provides sound and economical engineering as a part of their service.

2 **ADVANCED STANDARDS OF CONSTRUCTION . . .** have distinguished PANELLIT in every detail of structure, finish, piping, terminal arrangements and serviceable behind-the-panel layouts.

3 **PIONEERING CONCEPTS OF INSTRUMENTATION . . .** the graphic control panel, miniature instrumentation, unitized annunciator systems, scanning and monitoring devices . . . all have been closely associated with PANELLIT.

4 **ORGANIZATIONAL FLEXIBILITY . . .** Few process control panels are ever shipped without changes. When "change orders" are received, PANELLIT moves quickly to carry them out . . . without confusion . . . without delay. Where others take weeks, PANELLIT takes hours.

5 **THE ONE MAN PLAN . . .** makes PANELLIT easy to work with. One project engineer stays with your job. There are no "pass along instructions" or "round about authority".

6 **INFORMATION SYSTEMS . . .** an advanced PANELLIT concept of the control panel has resulted in better process control. An *information system* filters information for the operator to know . . . and presents it in a manner that he may act quickly and instinctively. *Write for complete information.*

PANELLIT

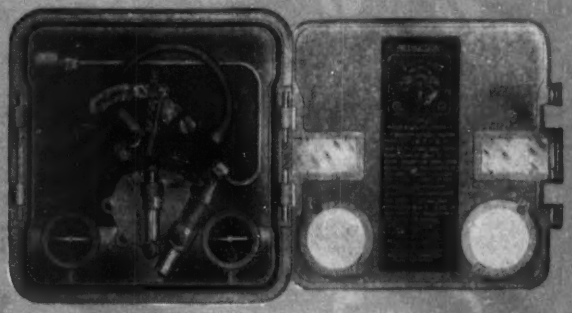
INFORMATION SYSTEMS

PANELLIT, INC., 6312 N. BROADWAY

CHICAGO 40, ILLINOIS

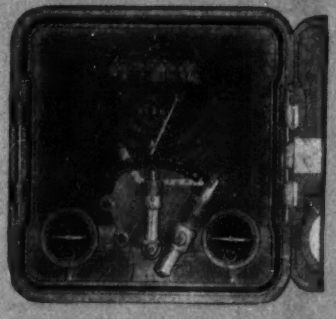
BS&B Announces:

. . . An Even Better Pressure Controller — Climax Type 1440



The Climax Type 1440 Pressure Controller (non-recording) is designed to handle both positive and negative pressures, from high vacuum to pressures of up to 10,000 lbs. Bourdon Tube actuated — with all tubes, bellows assemblies, feed orifices and bleed nozzles calibrated — the Type 1440 is an instrument of utmost accuracy. Proportional band and On-Off or Maximum-Minimum snap action adjustment is easily made without additional parts. Snap action may be adjusted to pressures up to 75% of the limits of the Bourdon Tube rating.

. . . An Even Better Liquid Level Controller Pilot . . . Climax Type 1450



The type 1450 Liquid Level Controller Pilot was developed for use and mounting on any Climax Type 888, 888-LF, 887 and 880 displacement liquid level controllers where a torsion tube transmits float movements to reflect changes in liquid level or a change in gravity of the controlled liquid. Its interchangeability of parts with those of the Type 1440 Pressure Controller is an advantage which reduces stocking parts.

Type 1450 features a very wide "throttling" range calibrated from 0% to 100%. A specific gravity index is provided and offers a method of compensating for various gravities of liquids, or for inter-face services, where the "throttling" range is kept exact in its relationship to the specific gravity setting.

A novel feature of the Type 1450 is its adjustability, without use of special parts, for "snap" or "on-off" action. This is useful when it becomes desirable for the diaphragm control valve to fully open or close when liquid level height reaches a desired "high" setting, and to react in an opposite manner at a desired "low" setting. The amount of liquid level change from open to shut positions of the control valve may be varied up to 75% of displacement element length.

Improved Features of Types 1440 and 1450:

1. Weatherproof case of die-cast aluminum designed for universal mounting.
2. Compact size — 8" x 8" x 4".
3. Door hinges to left or right, as desired.
4. Straight line piping.
5. Proportional bellows, calibrated, spring opposed.
6. Micro-adjusted set-point, graduated.
7. Molded diaphragms in power unit.
8. Easy parts replacement or assembly.
9. Feed orifice cleaner.
10. Snap action available over 10% to 75% of tube range without additional parts. (Applies to Type 1440 only.)
11. Pilot action reversible by moving a single link, without tools.
12. Elimination of superfluous linkages, resulting in easier adjustability and greater sensitivity.

Types 1440 and 1450 Have Been Developed and Thoroughly Field Tested for More Than Two Years!

Types 1440 and 1450 are but a small part of the complete Climax line—designed, engineered and precision manufactured by BS&B to meet your most exacting requirements. Send for your free copy of the complete Climax catalog!

For Better Process Controls . . . Always Specify BS&B Climax!

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

BLACK, SIVALLS & BRYSON, INC.
Climax Controls Division, Dept. 4-N5
7500 East 12th Street Kansas City 26, Missouri

CHROMALOX

Electric Heaters

STRIP HEATERS

In straight lengths, formed or "finned" for conduction or convection heating. Industry's rugged and versatile heat source for many uses.

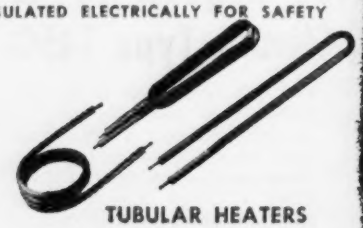
CARTRIDGE HEATERS

Installed in an instant in drilled holes for heating dies, platens, moving parts, rolls, molds, etc. Types available for immersion heating in liquids.

SHEATHED IN METAL FOR STRENGTH—INSULATED ELECTRICALLY FOR SAFETY

IMMERSION HEATERS

For heating water, oil and other liquids. Wide variety of types and sizes for portable or permanent installations, with or without built-in thermostats.



TUBULAR HEATERS

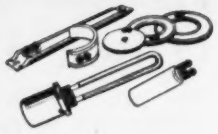
Straight lengths or tailored to any desired shape. For heating liquids, solids or gases by conduction, convection or radiation. Many sheath types.

Your LOW COST SOLUTION to processing heat problems!

Chromalox Electric Heaters give you quick, on-the-spot heat for a wide range of uses. They provide dependable, efficient, economical around-the-clock service in applications requiring continuous, accurately controlled temperatures. Thousands of plants in all industries have found Chromalox Heaters the low cost solution for heating liquids and gases; for heating dies, platens, moving parts; for superheating steam and pre-heating oil; in fact—for almost every industrial application using heat.

CHROMALOX

OFFERS YOU THE MOST IN ELECTRIC HEAT



Selection . . .

Over 15,000 types, sizes and ratings fill most applications needing heat up to 1100° F.

Engineering . . .

Research, development and technical personnel provide a vast reservoir of industrial heating know-how.

Experience . . .

World's largest manufacturer of electric heating units exclusively. 35 years of designing and manufacturing skills.

Service . . .

Over 130 field engineers in 36 key cities give on-the-job assistance and counsel.

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CHROMALOX

Electric Heat for Modern Industry

YOURS
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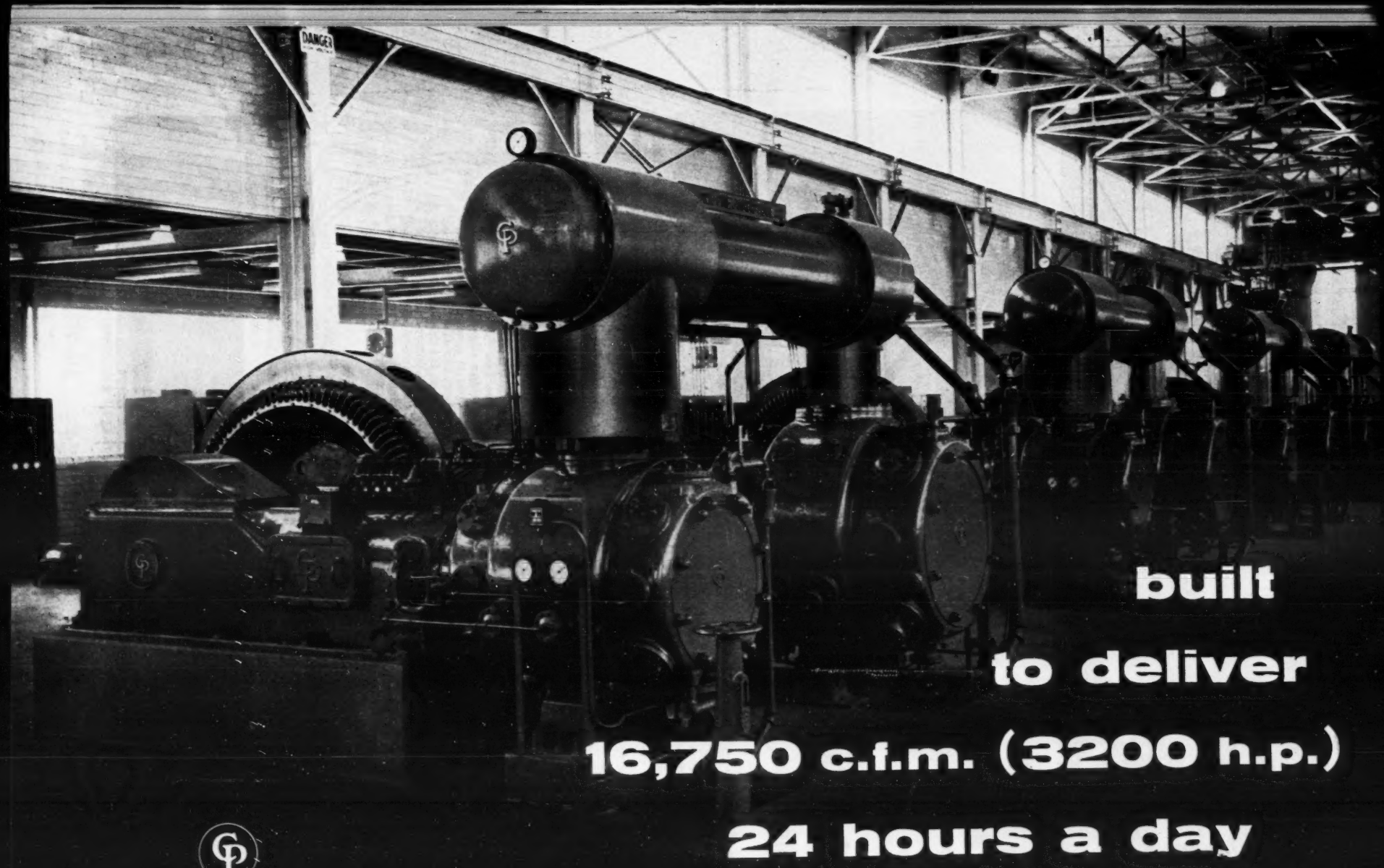
Catalog 50 is a storehouse of valuable information and data on many of the 15,000 Chromalox Electric Heating Units. Write today for your copy.

EDWIN L. WIEGAND COMPANY, 7514 THOMAS BOULEVARD, PITTSBURGH 8, PA.



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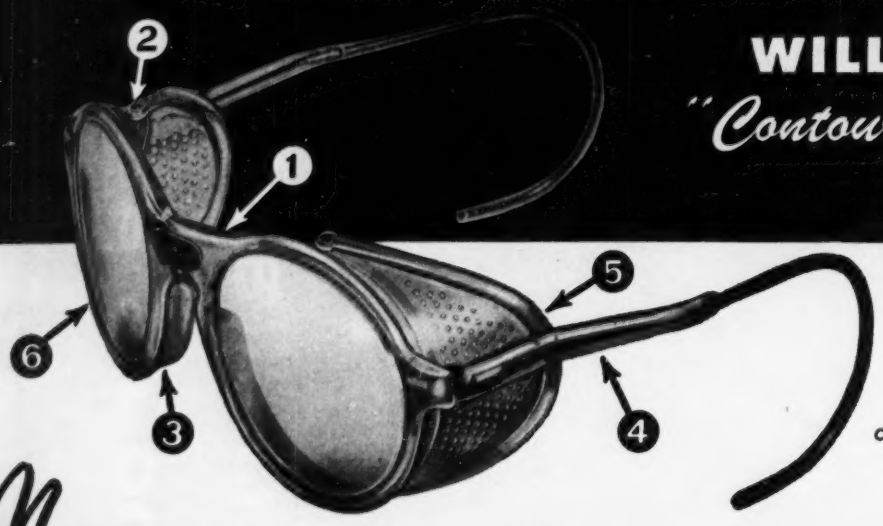
first really new *development in safety spectacles in years!*

WILLSON
*"Contour-Spec"**



Style WCS47
Covered by Design Patent 168,988

New... hinged bridge gives snug, comfortable fit . . . self-adjusting to *any* facial contour!

1. **New hinged bridge** combines the flexibility of cup-type goggles with the lightweight, compact protection of safety spectacles.

2. **One all-purpose size** permits universal fit. Bridge hinge gives automatic adjustment to any bridge width from 18-26 mm.; one eye size—47 mm.—fits everybody. *No need to stock a variety of bridge and eye sizes.*

3. **Plastic nose-and-cheek pads** provide *full closure* around eye cavity.

4. **Contour-shaped** adjustable plastic-and-cable temples hold spectacles firmly in place.

5. **Matching sideshields** are perforated plastic, providing protection at sides—*fold back* for pocket compactness.

Order a supply of Contour-Specs from your Willson distributor. Let your workers try their amazingly greater comfort, and see how they're preferred over ordinary safety spectacles!

6. **Butyrate frame**—*toughest plastic used for spectacles.* Standard frame is flesh colored, fitted with 6-curve Willson Super-Tough® glass lenses. Available also with green frame and sideshields, fitted with Willsonite® Super-Tough green glass lenses.

Hinged to fit any face snugly!

See how the unique hinged bridge allows the Contour-Spec to open up to fit broad faces and close up for narrow faces. It's this feature that allows Contour-Specs to contact the entire eye cavity and makes them fit so comfortably yet securely.

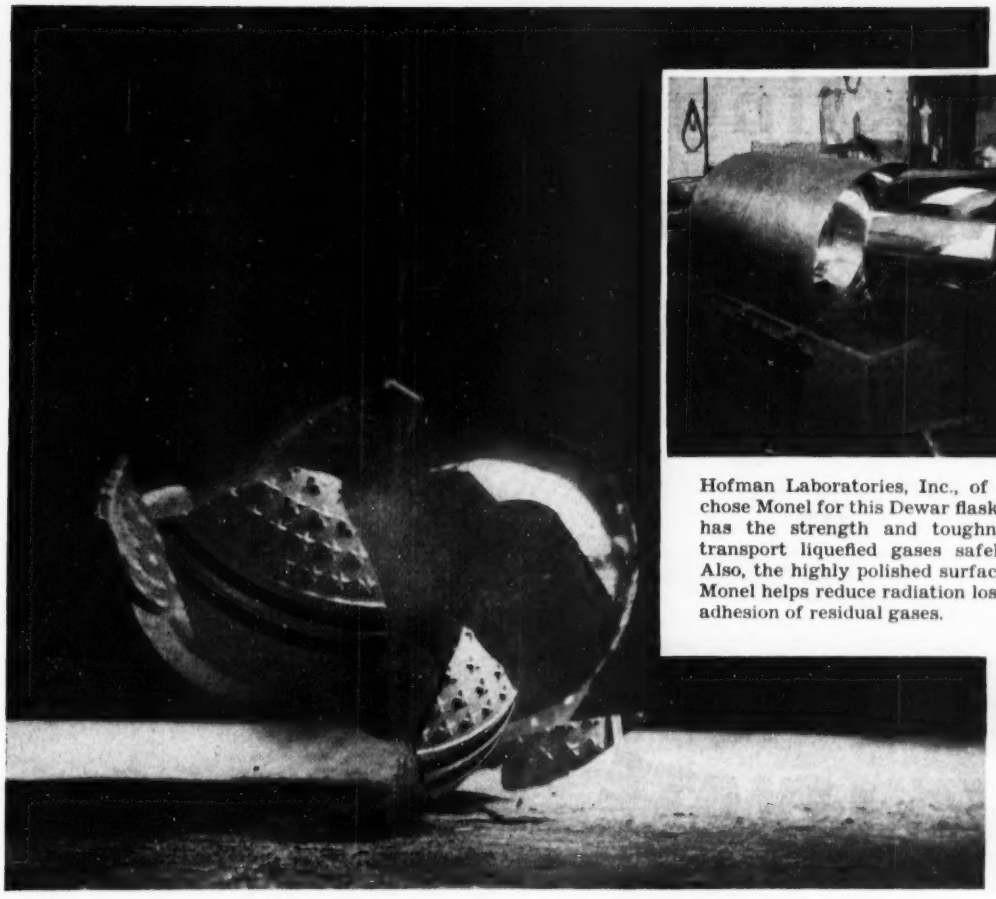
*Trademark

More Than 300 Safety Products Carry This Famous Trademark

WILLSON

Established 1870

WILLSON PRODUCTS, INC., 106 THORN STREET, READING, PA.



Hofman Laboratories, Inc., of Newark, N. J. chose Monel for this Dewar flask because Monel has the strength and toughness needed to transport liquefied gases safely at —330°F. Also, the highly polished surface possible with Monel helps reduce radiation loss and minimize adhesion of residual gases.

Some frozen *food for thought in this rubber ball that didn't bounce!*

At minus 320°F. a child's rubber ball bounces like a flower pot – into pieces.

And what happens to normally soft rubber happens to *most* other materials at extremely low temperatures.

Many metals become too brittle to use. An alloy steel, with a room temperature impact strength of 119 foot-pounds, shows a drop in impact strength to only 6 foot-pounds at the temperature of liquid nitrogen.

One metal, Nickel, withstands and prevents such embrittlement. High nickel alloys like Monel and Inconel keep their toughness – ductility – clear down to within a few degrees of absolute zero. Even the impact properties of weldments are essentially insensitive to temperatures as low as the temperature of liquid nitrogen.

Surprisingly enough, when temperatures drop, Inco Nickel Alloys actually *increase in yield strength and tensile strength without appreciable change in ductility.*

Because of these outstanding low temperature physical properties, Monel and the other Inco Nickel Alloys are used for storing liquefied gases, and for containing and handling many substances at low temperature. Inconel, for example, is used in producing and storing liquid helium. And "K" Monel is used for piston rods and sleeves of compressors for manufacturing liquid oxygen. Besides its good low temperature properties and corrosion resistance, "K" Monel gives the extra strength ordinarily found only in heat-treated alloy steels.

If you have a low temperature equipment problem, consult engineers of Inco's Technical Service Section. They will gladly help you – without cost or obligation, of course.

And for more information, tables and graphs – the *cold facts* about Inco Nickel Alloys – write for a reprint of the article, "High Properties at Low Temperatures."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **Nickel Alloys**

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL • "S"® MONEL
INCONEL® • INCONEL "X"® • INCONEL "W"® • INCOLOY®
NIMONIC® Alloys • NICKEL • LOW CARBON NICKEL • DURANICKEL®

Testing Brine Strength through the Ages...

or

"FROM LOTUS TO LIXATE"

TODAY, brine is a precision ingredient with hundreds of exacting uses in industry. Its strength must be accurate, controlled, and constant.

A simple Lixator installation solves this age-old problem—makes uniform brine automatically.

It cuts handling and labor costs—delivers a steady flow of pure, 100% saturated brine to any point in your plant at the twist of a valve. You use STERLING ROCK SALT—and gravity does all the work. Automatically. Instantly.

The LIXATE Process is adaptable to your particular requirements. Write, and our representative will show you how. No cost, no obligation.

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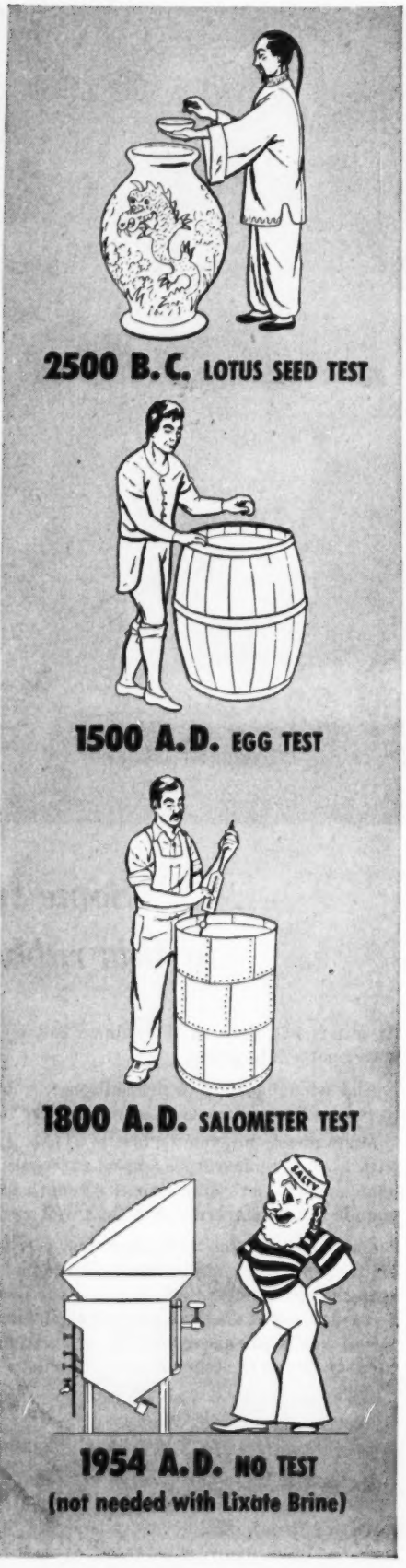
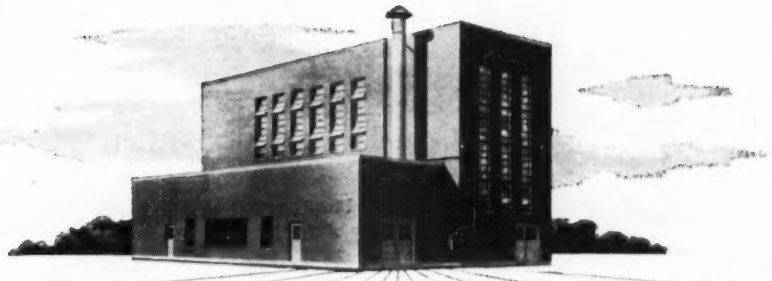
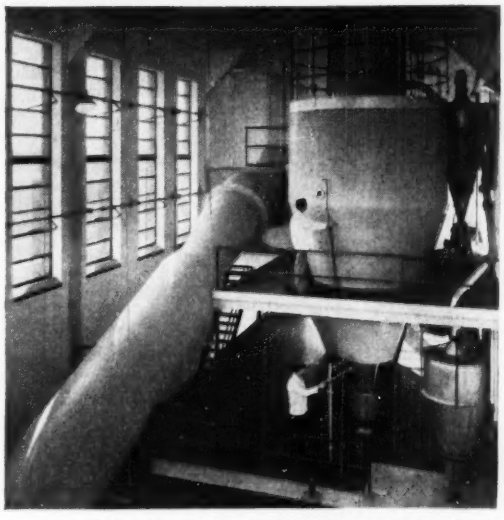




Can your product graduate from this "UNIVERSITY" of DRYING?



The world's most advanced spray dryer laboratory—located at Harvey, Illinois. Designed to provide maximum flexibility for handling many types of materials under a wide range of conditions.

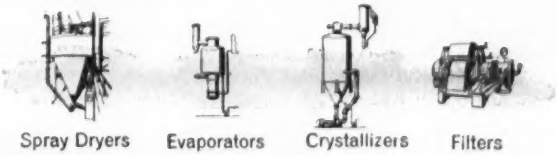
If a Test Quantity can pass the "Dry Test" here... it is likely any quantity can be successfully spray dried in your own plant!

Can the "magic" of spray drying give *your* product a new form, more markets, or a big boost in profit potential? The surest way to find out is to commercially test it at the "school of learning" devoted to such problems... Swenson's Spray Dryer Laboratory at Harvey, Illinois.

Here Swenson engineers thoroughly test and analyze your product's potentials... in a *commercial-size* spray dryer, under full scale operating conditions. The results you get from experimental tests, in barrel or carload lots, will match those of actual production conditions. If your product "graduates" here, *you'll know the facts before major investment is required!*

Swenson is ready to help you in *every* phase... analysis, layout, design and manufacture of equipment, and initial supervision of the job. Talk spray drying with Swenson today.

SWENSON EVAPORATOR COMPANY
15669 Lathrop Avenue, Harvey, Illinois



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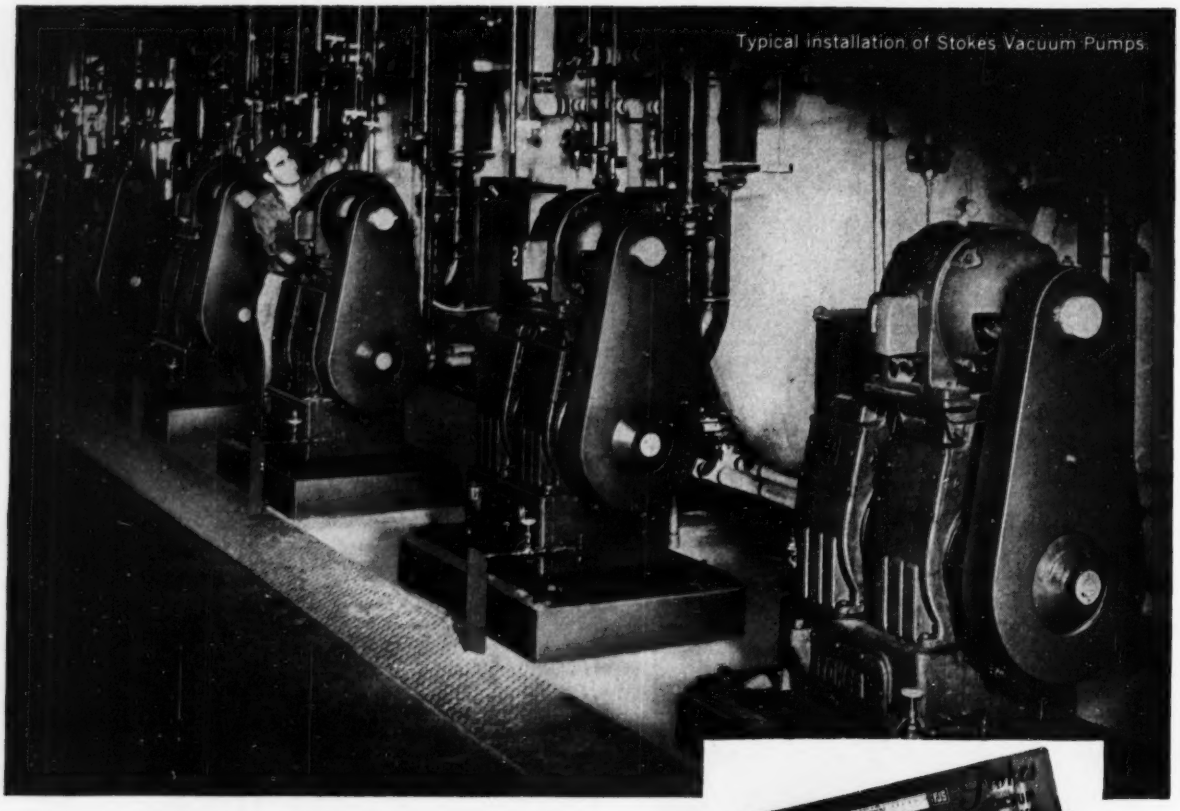


Typical installation of Stokes Vacuum Pumps

Stokes Microvac Pumps... basic to Vacuum Processing

High volumetric and mechanical efficiency make these famous pumps economical and reliable units in any vacuum system.

Capacities of Stokes Microvac Pumps run from 15 to 500 cfm . . . pressures to 10 microns absolute. Power consumption is low and the top-mounted motor contributes to compact design requiring minimum floor space.

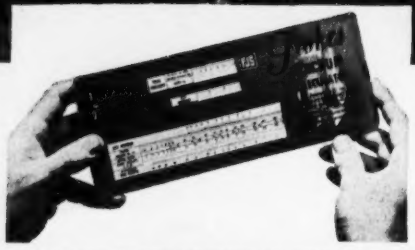
Lubrication of the four moving parts (including the exhaust valve of corrosion-resistant Teflon) is fully automatic. There are no stuffing-boxes or grease-fittings, and no packing.

Parts are precision-finished, standard and interchangeable. Freedom from wear assures years of trouble-proof service.

Stokes is the only manufacturer of equipment for complete vacuum systems, including Microvac mechanical pumps, oil diffusion pumps, McLeod Gages and Vacuum Valves.

Consult with Stokes on the application of vacuum to drying, freeze-drying, impregnating, extraction, solvent recovery, evaporating, vacuum metallizing, and to other purposes for which vacuum deserves exploration.

F. J. Stokes Machine Company,
Philadelphia, Pa.



Send for new Vacuum Calculator for rapid slide-rule calculations. Includes standard ABCD log scale. Also send for Catalog 700, "Stokes Microvac Pumps for High Vacuum," with copious reference material.

Send for copy of a new handbook "How to Care for Your Vacuum Pump." (Bulletin No. 755). Contains many valuable suggestions about installation, starting, servicing, trouble-shooting, and helpful "Do's" and "Don'ts" on vacuum pumps and systems.

STOKES

STOKES MAKES Plastics Molding Presses / Industrial Tabletting and Powder Metal Presses / Pharmaceutical Equipment / Vacuum Equipment / High Vacuum Pumps and Gages / Special Machinery

What one tube steel will give you the best life/cost ratio? *Ask the experts!*

This month's report is on: **DM STEEL**

Has unusually high creep strength for a pearlitic steel, good stability up to 1200° F., fairly good corrosion and oxidation resistance. Has 2 to 3 times the life of carbon steel where corrosion is not severe. Recommended for cracking furnace tubes, hot oil lines, superheater tubes, high temperature steam piping and forgings for accessory parts.

ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS

Carbon	Sicromo 2	Sicromo 5S	18-8 Ti
Carbon-Mo.	Sicromo 2¼	Sicromo 5MS	16-13-3
DM-2	2¼% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

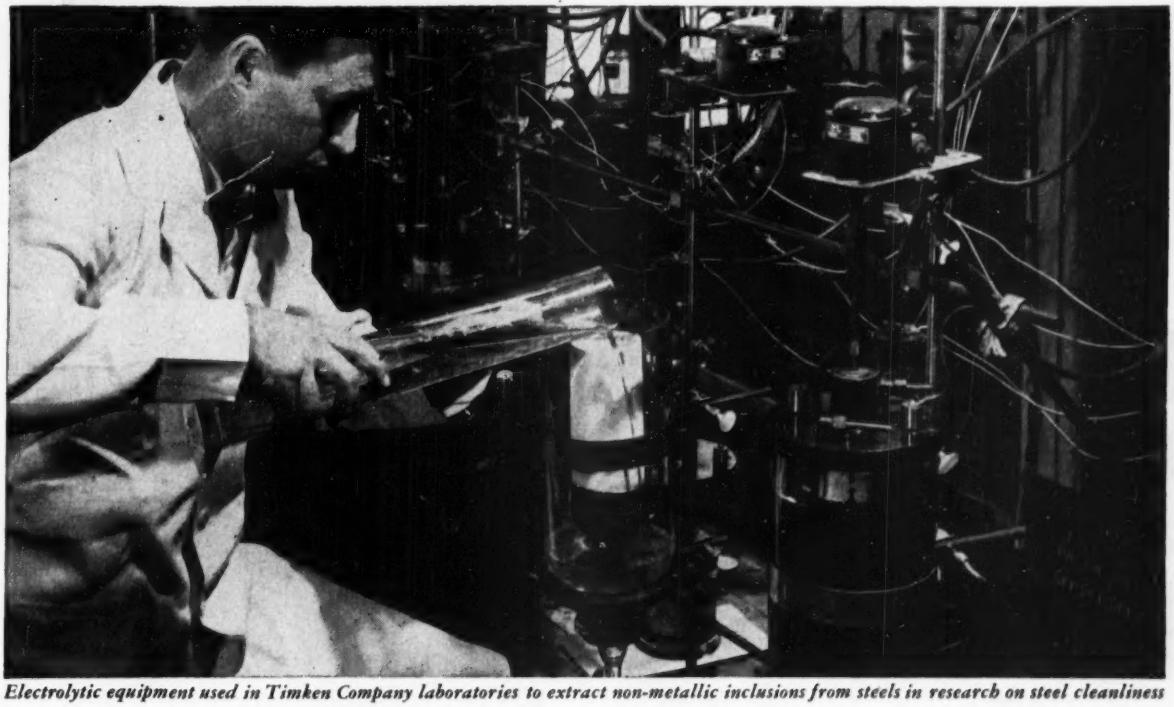
**Available as seamless tubing on an experimental basis only.*
***Not available as seamless tubing.*

THERE are probably several high temperature tube steels that will solve your heat, pressure, corrosion and oxidation problems. But there's only one analysis that will give you maximum tube life per dollar.

To find it, *ask the experts!*

With over 20 years of steel research and experience, Timken Company metallurgists are recognized authorities on high temperature steels. They'll use this experience to help you select from 24 different analyses, pick the one tube steel that will give you the best life/cost ratio. And regardless which analysis you select, you'll be assured of uniform quality because the Timken Company rigidly controls quality from melt shop through final inspection.

Let the Timken Company's RSQ—Research, Supply, Quality—solve your tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Electrolytic equipment used in Timken Company laboratories to extract non-metallic inclusions from steels in research on steel cleanliness

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

...in this electrolytic application

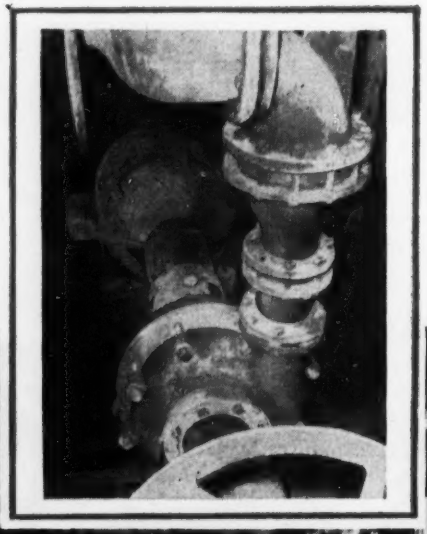
WILFLEY ACID PUMPS

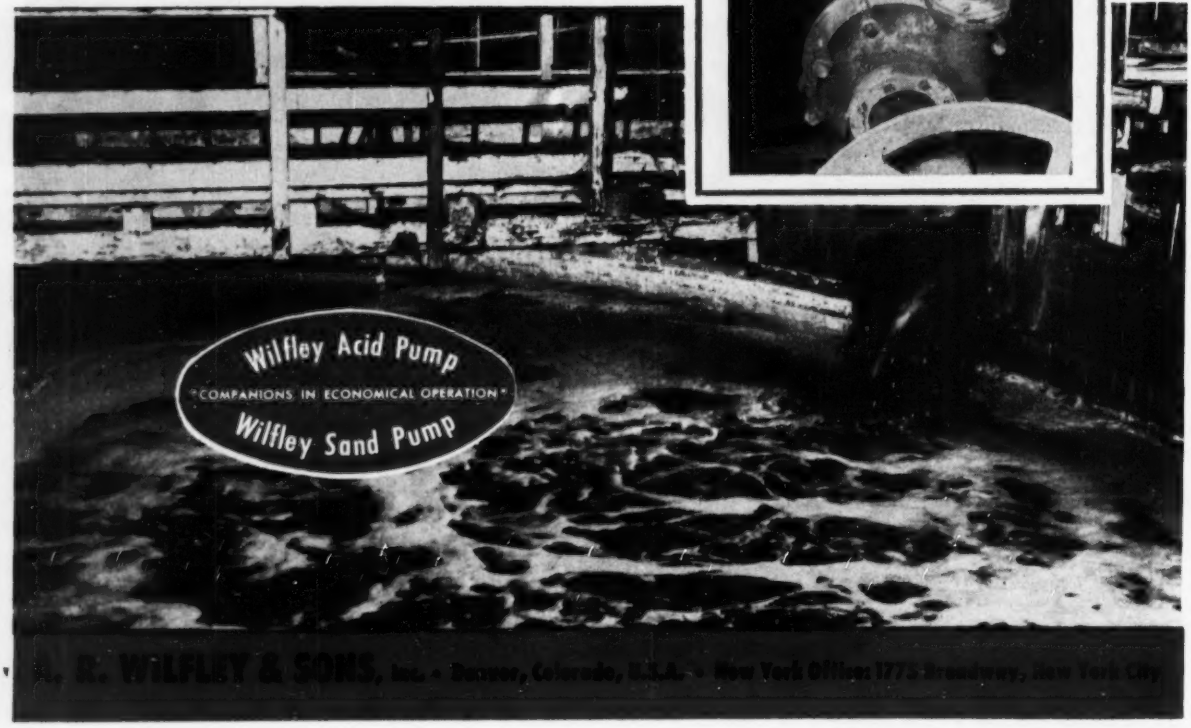
Reduce Costs and Increase Production

Wherever you find Wilfley Acid Pumps you find consistent cost-saving performance—especially on difficult pumping jobs. Continuous, trouble-free operation 24 hours a day without attention. Individual engineering on every application.

- **10- to 2,000-G.P.M. capacity; 15- to 150-ft. heads and higher.**
- **Wetted parts of all machinable alloys; plastic linings available.**

Write or wire for complete details.





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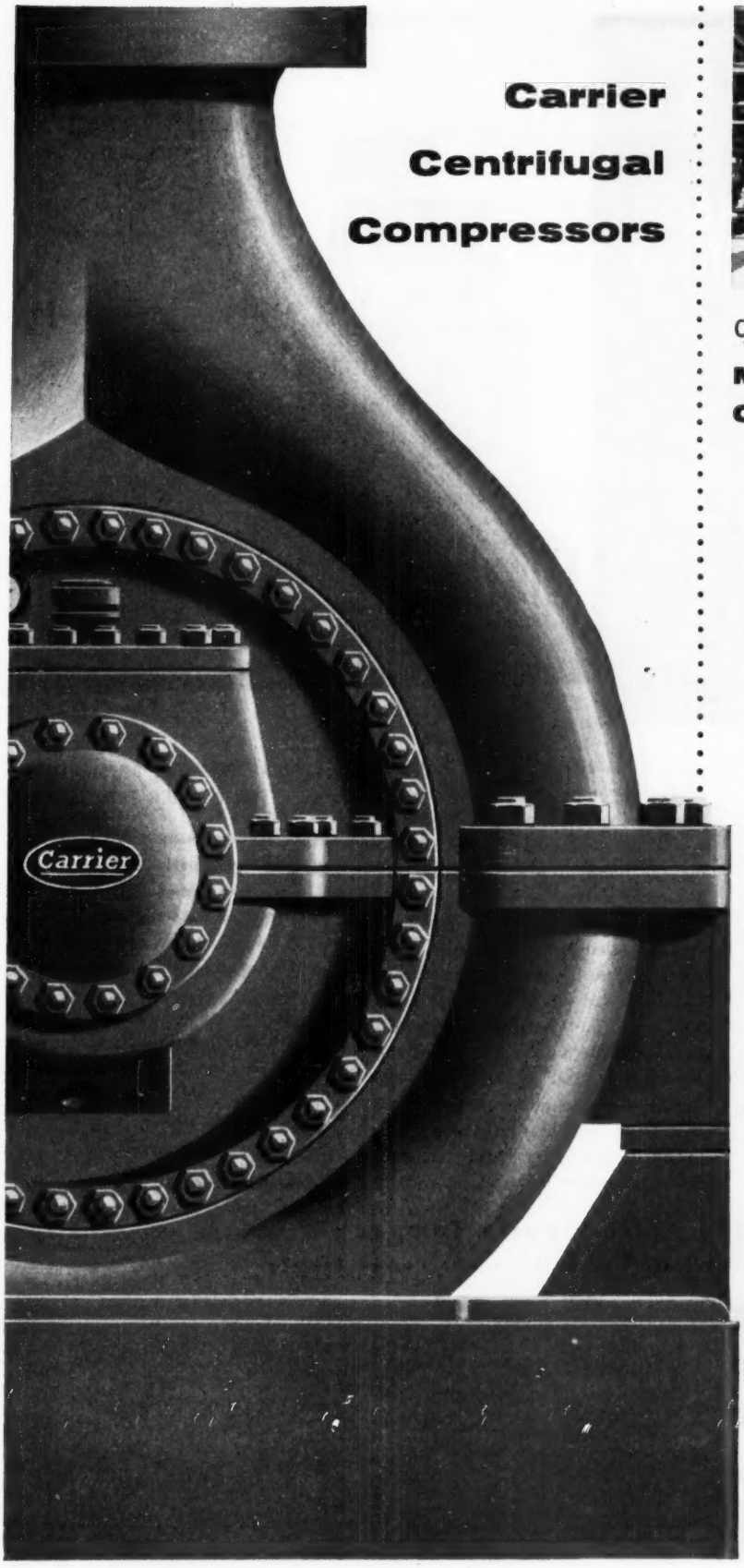
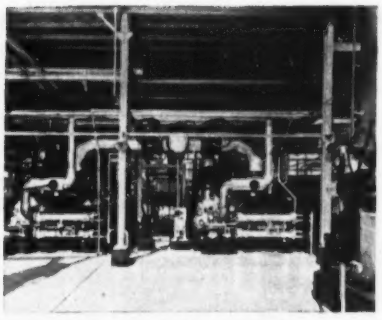


Carrier

Centrifugal

Compressors



on the job at

Magnolia Petroleum Company

These two Carrier Centrifugal Compressors are on the job at Magnolia's Seeligson plant, Premont, Texas. Each unit handles 2960 cfm of butane and operates at 7550 rpm.

Carrier makes a complete line of centrifugals for gas compression and refrigeration—up to 10,000 hp in a single unit. There are hundreds of these dependable, efficient Carrier machines on the job at dozens of chemical plants and refineries across the country—serving such companies as The Atlantic Refining Company, Reichhold Chemicals Company, Cities Service Company, Wyandotte Chemicals Corporation, Standard Oil Company of California. May we assist *you?*

If you'd like a copy of our booklet,

"Centrifugal Compressors for Industry,"

please call your nearest Carrier office. Or write direct to Carrier Corporation, Syracuse, New York.

Carrier

centrifugal compressors

refrigerating equipment

Why ALDRICH PUMPS Reduce Maintenance Cost

ALDRICH

Write for catalogs, engineering service or a representative's call. We invite your inquiries.

Design simplicity . . . rugged construction

Aldrich Pumps are built to take punishing service year after year. You can find Aldrich Pumps, today, in good running order after 30, 40 and even 50 years of service. Durability such as this is the result of Aldrich's design simplicity and rugged construction.

Accessibility . . . sectionalization

When wearing parts are due for replacement, in Aldrich Pumps they can be replaced easily, quickly and at low cost. For instance, manifolds can be moved out on the holding studs and you can lift out and replace valves as complete units. . . . Stuffing boxes are particularly accessible—making it easy to renew packing. . . . To meet a change in pressure or capacity requirements, plunger sizes can be changed — in most cases merely by using new glands, throat bushings and packing in the same fluid-end. . . . Wearing parts are interchangeable among pumps of the same stroke size. . . . Fluid-ends are sectionalized to make possible low cost parts replacement and can be made of stainless steel, bronze, Monel or other material.

TYPICAL CHEMICAL APPLICATIONS FOR ALDRICH PUMPS:

caustic solutions	fatty acids
anhydrous ammonia	nitric acid
amine solution	cobalt solutions
pulp density mineral ore	acetic acid
aqua ammonia	gritty water
slurry nickel catalyst	urea

. . . as well as liquids encountered in petroleum refining, petrochemical and other industries . . . corrosive liquids, high viscosity, and/or high pressure applications.

Representatives in Principal Cities

The Aldrich Pump Company

3 Gordon Street • Allentown • Pennsylvania

If you deal with CORROSIVE liquids or gases under PRESSURE...

Here's Instant Automatic

RELEASE OF EXCESS PRESSURE

PRECIOUS METAL

RUPTURE DISCS

The safest and most dependable type of rupture disc for pressurized equipment —particularly where there is even the slightest degree of corrosive action present—is the corrosion-resistant precious metal rupture disc. Where discs and relief valves of base metal alloys, including stainless steel, are rendered dangerously inaccurate by corrosion, the precious metal disc will maintain its accuracy intact. Baker Precious Metal Rupture Discs are precision-made to your specifications, for pressures from a few pounds to thousands of pounds. And the precious metal is recoverable with high resale value, so that the additional final "use" cost of this more dependable protection is negligible.

Send the coupon for the Baker booklet, "Precious Metal Rupture Discs." Information and data to help you select the type of disc that will give you absolute protection.

BAKER & COMPANY, INC.

113 Astor Street, Newark 5, N. J.

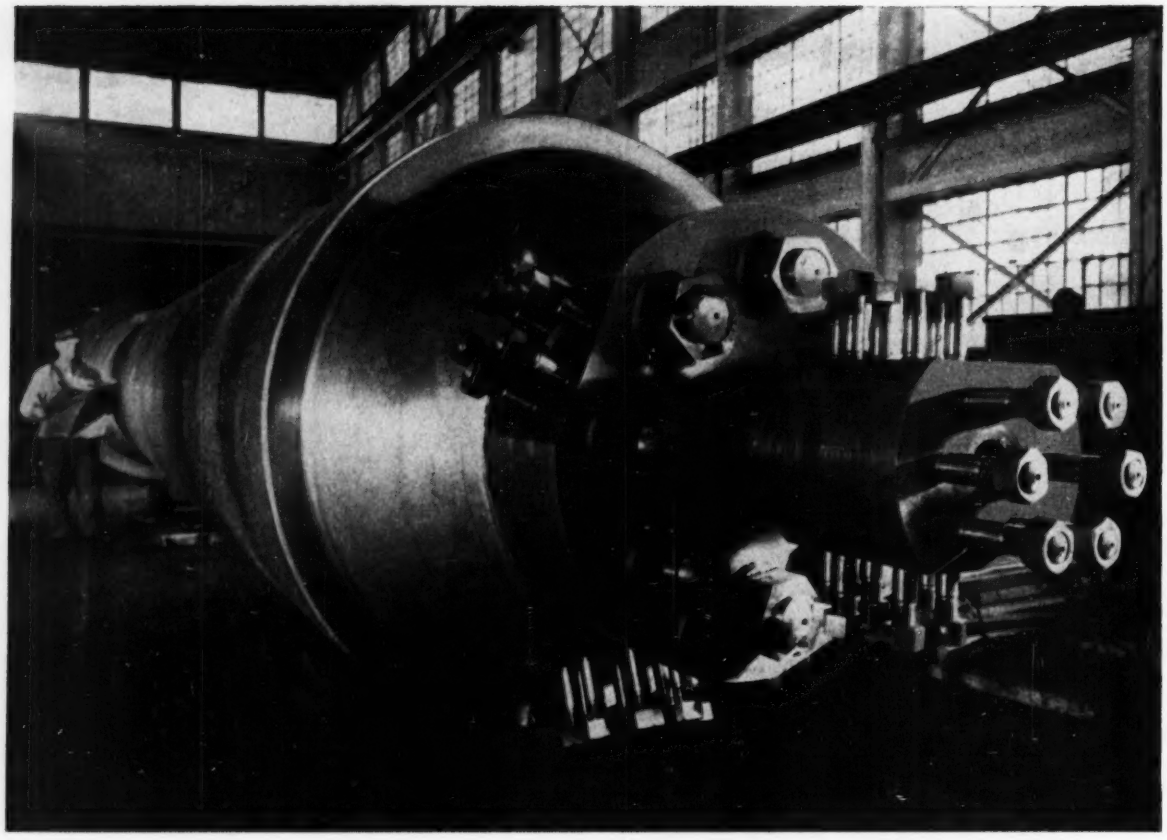
NEW YORK SAN FRANCISCO CHICAGO LOS ANGELES

BAKER & CO., INC.
113 Astor St., Newark 5, N. J.
Please send booklet, "Precious Metal Rupture Discs."

NAME.....

ADDRESS.....

CITY AND STATE.....



Anything you want in FORGED PRESSURE VESSELS

These two forged vessels represent unusual types, and posed some unusual problems during manufacture in our shops. They took a lot of thinking as well as doing; each in its way was a challenge to our staff.

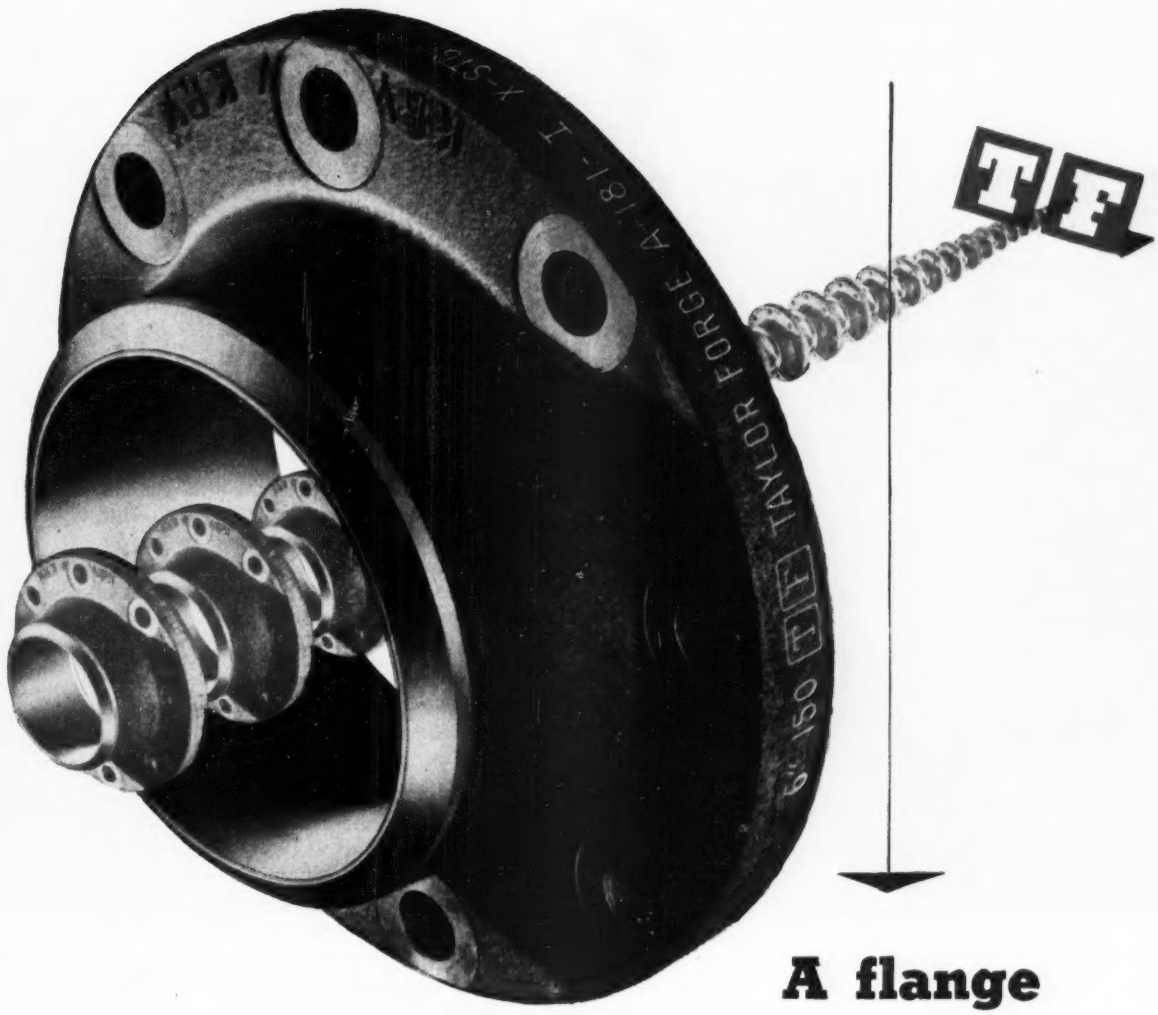
The short, stubby vessel has a 24-in. ID and weighs between three and four tons. A little fellow by most standards. It is a pygmy alongside the other one, which tips the beam at 145 tons and has an ID of almost four ft.

The two jobs illustrate a couple of points worth remembering. First, that Bethlehem is well equipped to handle odd and unusual forged-steel vessels, as well as conventional types. Second, that Bethlehem can build any size you need, from the very small to the giants.

When you are next in the market for autoclaves, reactors, converters, separators, filters, or high-pressure accumulators, by all means get in touch with us. Our engineers can be very helpful during the planning stage, and they are always glad to render all possible assistance.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



A flange with a background . . .

You are looking at a flange with a history. Taylor Forge made the forged steel flange and in a sense the forged steel flange made Taylor Forge. It was Taylor Forge, back in 1905, who made the first forged steel flanges on a commercial scale . . . and it is Taylor Forge who has guided flange development across the past half century.

Through the first threaded flange form, the bolted Van Stone form, and the perfected welding neck form pictured here, Taylor Forge has undeniably contributed more to flange development than any other organization*.

Taylor Forge Welding Neck Flanges are a part of the WeldELL® line—the line that more than 20 years ago gave industry the first complete line of fittings for pipe welding. The organization that led development is still leading . . . in scope of types, sizes, weights, materials . . . in quality and downright value!

For up-to-the-minute facts see your Taylor Forge Distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices & Works: P.O. Box 485, Chicago 90

Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

* When pressures rose from the old 150- and 300-pound standards to 400, 600 and finally 900 pounds, it was largely the exhaustive research of Taylor Forge that supplied the formulas for determining stresses in flanges for any given condition of loading. Among many examples: the Taylor-Waters formula, published in 1927, became and still is the basis of recognized practice for flanges in sizes through 24". Again, in 1938 Taylor Forge published the first edition of the now authoritative "Modern Flange Design" based on methods proposed by E. O. Waters, D. B. Rossheim, D. B. Wesstrom and F. S. G. Williams, Taylor Forge Manager of Engineering Standards. (ASME Trans., Apr. 1937)

6-inch plant wrecker

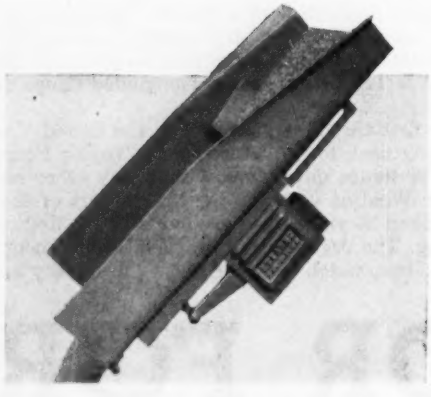
Just an ordinary, harmless bolt, the kind you can buy in any hardware store for a few cents. But, mixed with materials going through a pulverizer, it not only wrecks costly equipment, but can spark fires and explosions causing thousands of dollars damage.

Keep this troublemaker out with a Stearns spout magnet! Easily installed in conveyor systems, feed chutes, etc., powerful Stearns spout magnets automatically trap and remove tramp iron that is buried in bulk materials entering the plant.

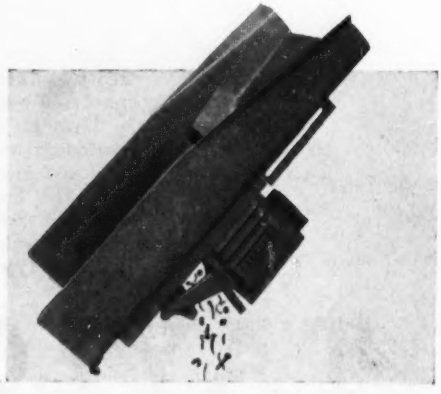
In addition to providing a strong, deep magnetic field, Stearns electro spout magnets are automatically cleaned. Simply open the conveniently located control switch and tramp iron drops out — close switch and magnet is again in operation. No ladders to climb — no hand cleaning.

Reduce explosion, fire and equipment damage, cut insurance rates with a Stearns electro or permanent spout magnet. Your request for Stearns Bulletins 92F and 97E is a positive step to plant safety and product purification. Do it today!

1087



Stearns Spout Magnet in operating position showing material flow over the magnet with tramp iron gate closed and current on.

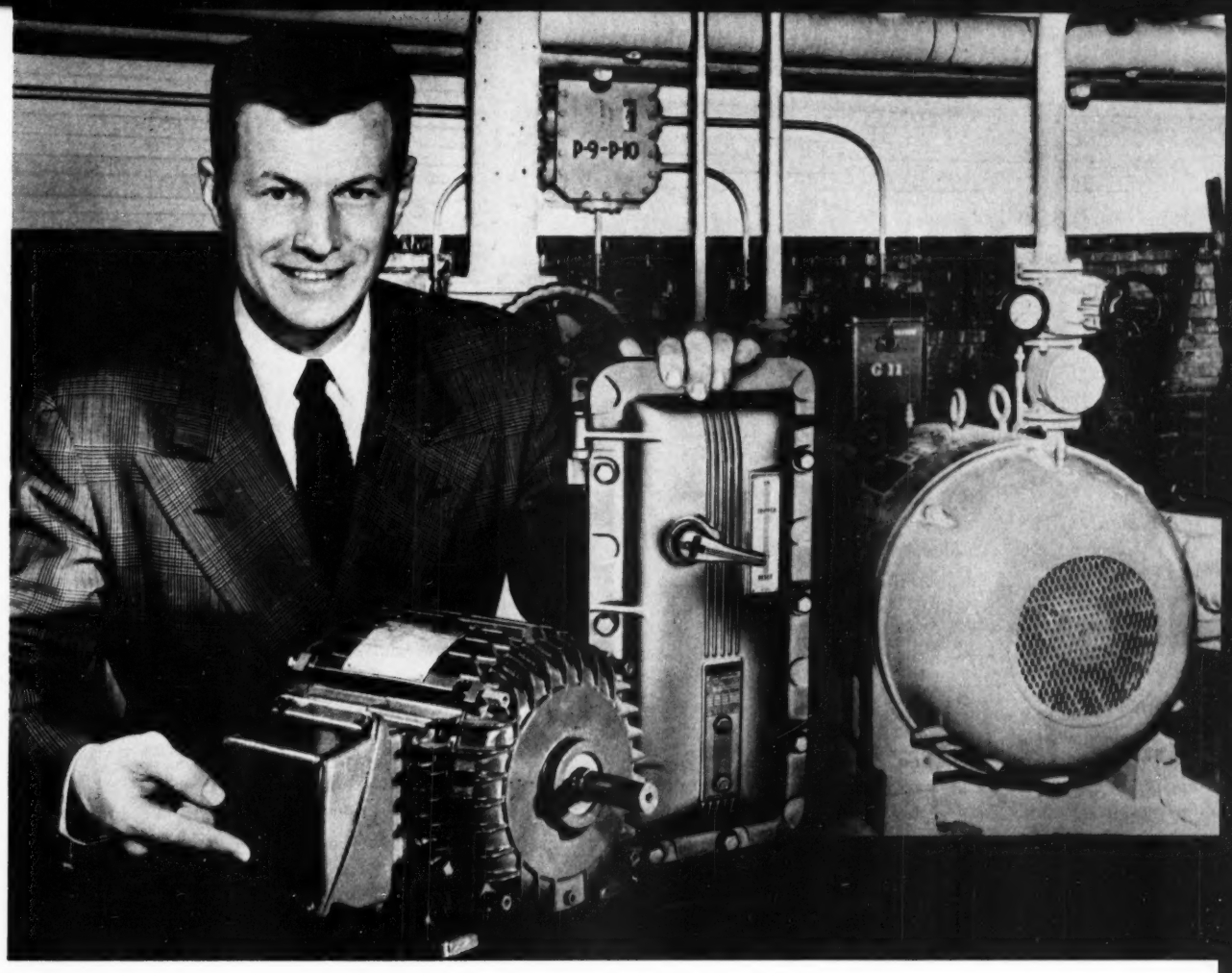


Here the current has been shut off at the control switch, magnet demagnetized, and tramp iron automatically discharged.

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS MAGNETS

STEARNS MAGNETIC, INC. 628 S. 28th St., Milwaukee 46, Wis.



What you can do to attain round-the-clock production continuity

HERE ARE 4 WAYS WESTINGHOUSE POWER PARTNERS CAN HELP

Motion is basic to all chemical processing. Materials must be moved, mashed, blown, crushed and moved again. Keeping that motion uninterrupted is a mountainous task, but one that can be simplified by using time-proved Life-Line® motors, gearmotors and controls. Here's how:

BETTER PROTECTION—Both inside and out, Life-Line motors, gearmotors and controls are built to take the beating inherent in the chemical industry. They are designed to cope with corrosion, shock and other mechanical hazards, dust, dirt, and outdoor exposure.

FEWER OUTAGES—Records show that Life-Line motors and gearmotors have an average outage rate of one-half that of conventional motors. Balanced design and advanced materials make the difference.

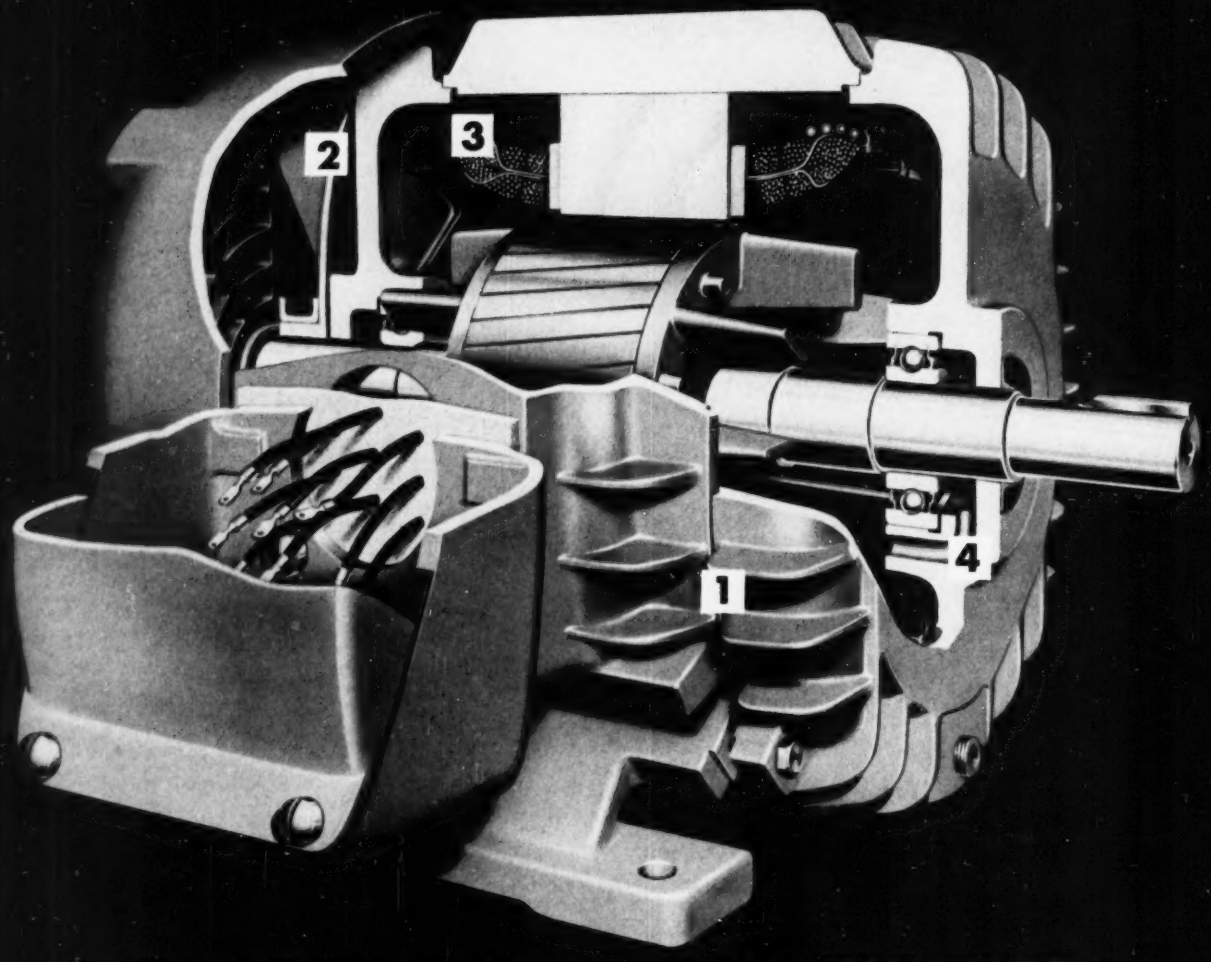
LESS MAINTENANCE—Less production time is lost maintaining Life-Line motors—they require no on-the-job greasing. Less production time is lost maintaining Life-Line controls.

THE MOST COMPLETE LINE—You don't get divided responsibility when you specify Life-Line. Westinghouse builds the most complete line of drives for the chemical industry . . . motors, controls, speed reducers and gearmotors. You can match the right motor, gearing and control to your specific need.

YOU CAN BE **SURE**...IF IT'S Westinghouse

THE NEXT THREE PAGES DISCUSS OTHER REASONS WHY LIFE-LINE MOTORS AND CONTROLS CAN HELP YOUR PRODUCTION CONTINUITY.

MINIMIZE CORROSION...



1. CORROSION-PROOF CAST IRON FRAME AND BRACKETS The housing is the one element that is responsible for protection of the internal parts of the motor. The Life-Line housing provides three-way protection: (1) only fine-grained castings are used, (2) all wall sections are uniformly thick, and (3) all fits are accurate and sealed.

2. CORROSION-PROOF FAN The external cooling fan is a critical member of a totally-enclosed, fan-cooled motor. By producing a sucking action, it draws large quantities of surrounding foreign material to it. This design dictates the use of thin-walled blades that are easy prey to corrosion. Life-Line solved the problem by making the fan of a rugged, chemically inert material—molded glass plastic.

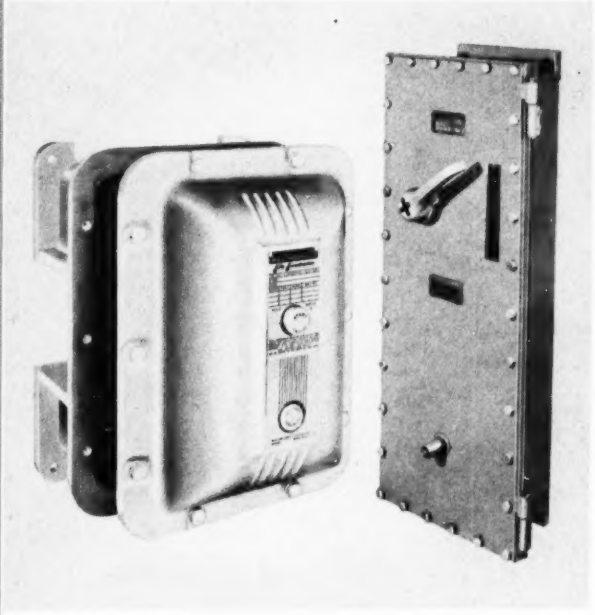
3. FORTIFIED INSULATION SYSTEMS Contaminating vapors can penetrate any totally-enclosed motor and attack the electrical components if they are not properly protected. Life-Line's insulation system makes sure this cannot happen. Only with Life-Line do you get the protection of Bondar conductor insulation combined with Bondite silicone-reinforced stator insulation ... a protective combination unsurpassed by any other motor.

4. AIR BYPASS Every totally-enclosed motor "breathes" as the internal air expands and contracts with change in temperature. Ordinary motors "breathe" along the shaft and through the bearings. Contaminated air enters the bearings and becomes a source of bearing failure. Life-Line eliminates this trouble source by providing an air bypass around the bearings.

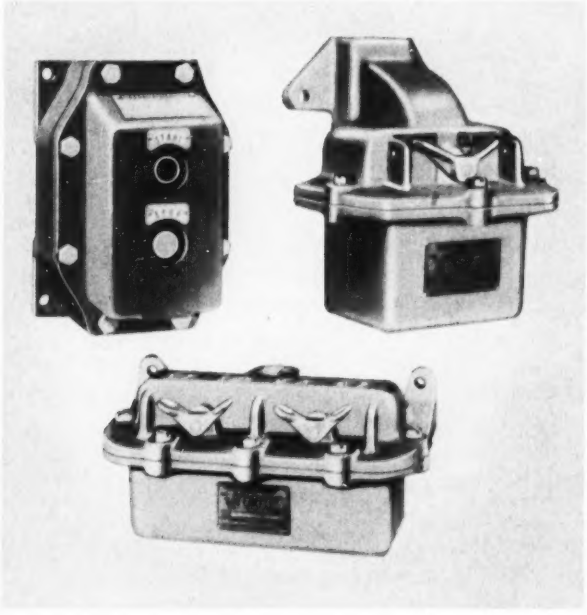
with Life-Line motors, gearmotors and controls

Corrosive solids, liquids, atmospheres, mild chemicals and severe chemicals—all must be reckoned with when applying motors, gearmotors and controls. Westinghouse equipment has been designed to give you maximum protection against the ravages of corrosion.

Life-Line motors, gearmotors and controls are also protected against physical abuse—bumps from passing vehicles—jars from falling objects—shocks from heavy machinery operation. Life-Line "A" motors combine the strength of fine-grained cast iron with the reinforcing of heavy ribs. False operation of contacts under vibration or accidental impact is no problem with the Westinghouse Life-Line Starter . . . the inverted knife-edge bearing is spring loaded and does not depend on gravity for operation.



All types of Westinghouse Controls are available in enclosures especially suited for use in the chemical industry. Linestarters® and combination Linestarters are available in heavy plate or cast-iron enclosures. Oil-immersed starters are available for corrosive and explosive atmosphere applications.



A large variety of Westinghouse Pushbuttons and pilot controls are available with cast-iron enclosures for use in severe operating conditions. Many chemical companies have found it desirable to locate their starters outside the corrosive areas and operate them remotely by these pushbuttons.

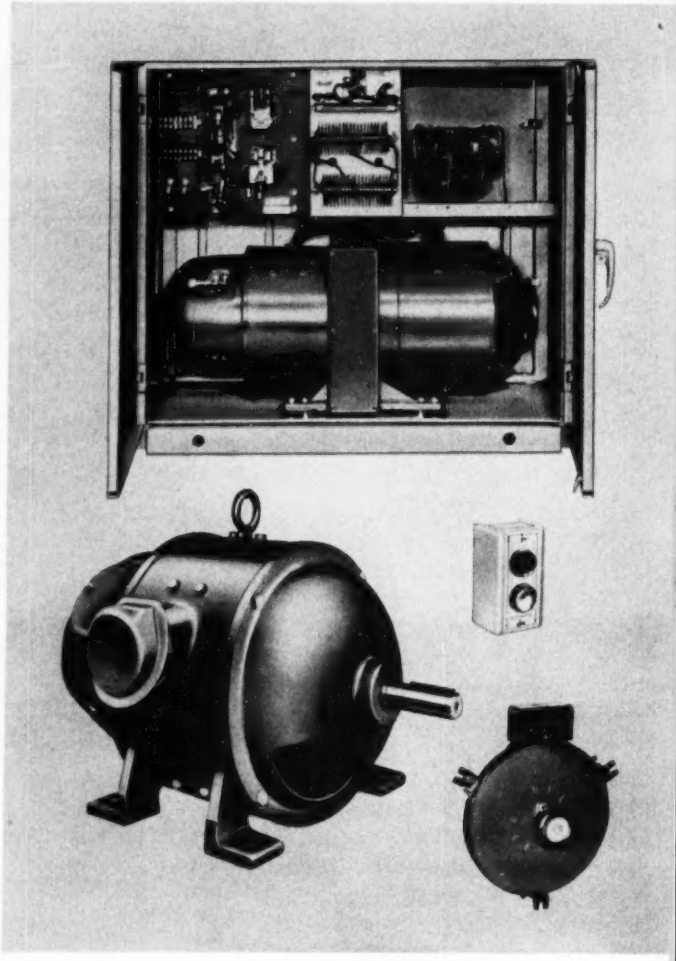
YOU CAN BE SURE...IF IT'S

Westinghouse

Turn to AV Packaged Drives to keep adjustable speed equipment running at peak capacity

The Westinghouse Life-Line AV Drive is a complete, adjustable-voltage drive system—a factory-engineered package. Flexible in application, this packaged drive serves the chemical industry wherever exacting speed control from an a-c power line is required. The Life-Line AV Drive provides: adjustable speed—precise speed regulation—smooth acceleration and deceleration.

Got a tough drive problem that is giving you trouble? Call on the services of a Westinghouse Consulting and Application Engineer. His specialized knowledge qualifies him to analyze fully your specific drive requirements and to recommend the proper equipment.



Here's the backup maintenance and repair service you get when you specify Westinghouse

Westinghouse Maintenance Service is a national organization established to meet all your needs for the repair or overhaul of electrical apparatus. **31 Warehouses,** located in prime industrial centers across the country, carry a well-rounded supply of Westinghouse Genuine Renewal Parts. **38 Specially Equipped Apparatus Repair Shops** are set up to repair every conceivable type of electrical apparatus. **46 Field Service Offices** are ready to make inspections, and on-the-spot repairs for equipment that cannot be moved easily. Ask your Westinghouse Representative how you can take advantage of these facilities. MP-3037

YOU CAN BE SURE...IF IT'S Westinghouse

Gentlemen:

Please send me the following Westinghouse literature:

Name .....

Firm .....

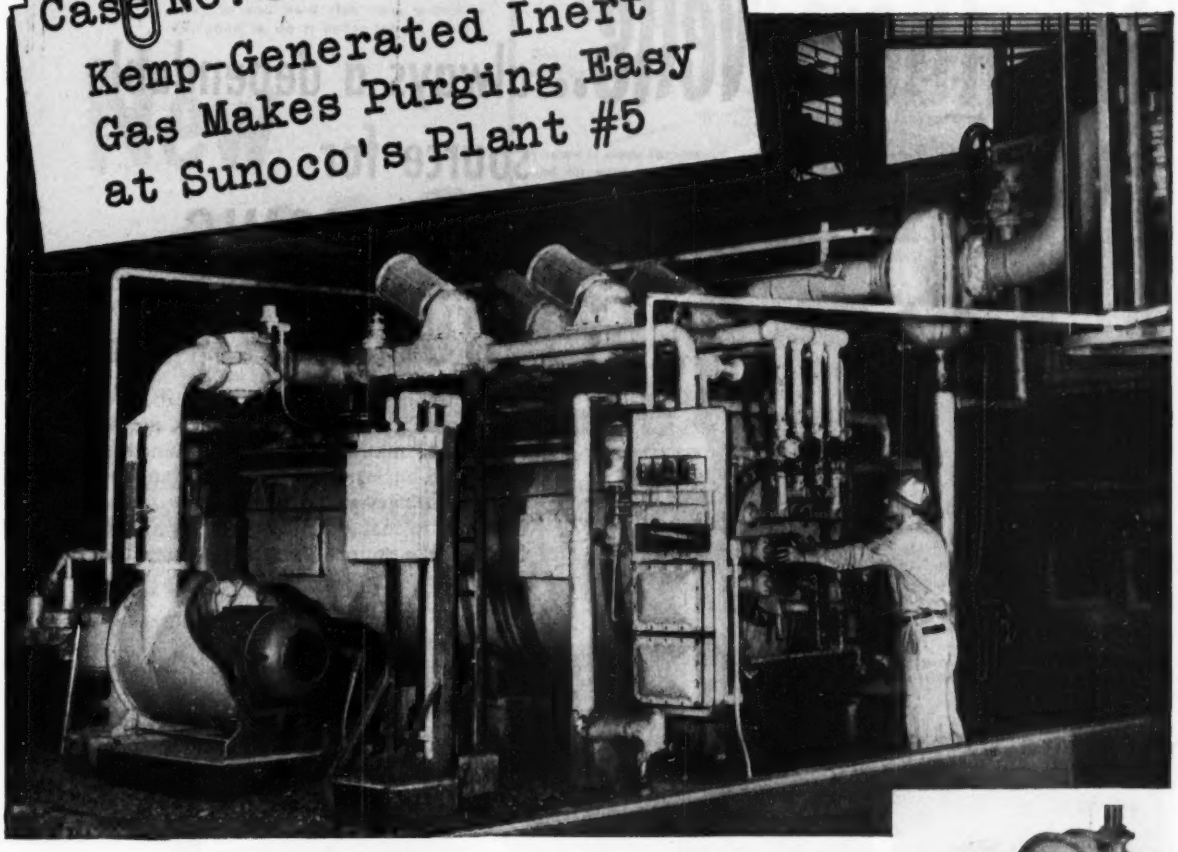
Address .....

City ..... State .....

SEND FOR THIS HELPFUL LITERATURE

- ☐ New Life-Line "A" Motor B-6154
- ☐ Life-Line AV Drives B-5808
- ☐ Automatic Operation Start with Westinghouse Control B-5882
- ☐ Complete Industrial Control and Services .. B-6051
- ☐ Westinghouse Motors and Controls in the Chemical Processing Industries B-4792
- ☐ Preventive Maintenance .. B-5477
- ☐ Life-Line Gearmotors B-5645

Case No. 57
Kemp-Generated Inert
Gas Makes Purging Easy
at Sunoco's Plant #5



How Sun Oil's "Magic Mill" at Toledo operates with 'round the clock safety

There's no *one* word that strikes terror in the hearts of oilmen everywhere more quickly than F-I-R-E! To combat this threat at the Sun Oil Co.'s giant refinery at Toledo, Ohio, constant vigilance, checks and inspections are the answer. And the liberal use of inert gas for purging pipelines, tanks and crackers is essential to this safety maintenance.

Kemp selected to do the job

When plans called for *doubling* plant production in 1950, a new Kemp Generator (see above) was installed to insure adequate inert gas production. Fast-starting, easy-to-operate, this Kemp unit more than filled the bill. Today tanks and lines are periodically purged for inspection and cleaning *as often as needed*. And thanks to its 60,000 cu. ft. per hr. Kemp Inert Gas Generator, Sunoco enjoys *exact analysis* inert production that meets all its purging requirements.

Let Kemp help you, too

If you have a purging or blanketing problem, why not let Kemp Engineers give you the same helpful advice used so profitably at Sun Oil's Toledo refinery. It costs you nothing to investigate. And it may save you money. Find out how Kemp's wide range of dependable, low-cost Generators (complete with the latest fire checks and safety devices) offer you the best way to solve your problems.

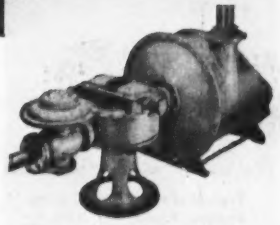
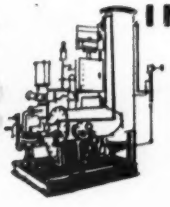


Photo above shows close-up view of Kemp Industrial Carburetor, the heart of every Kemp installation. Assures complete combustion... without waste, without tinkering. Reduces installation costs, simplifies maintenance.

For more complete facts and technical information, write for Bulletin I-10 to: **C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.**

KEMP OF BALTIMORE

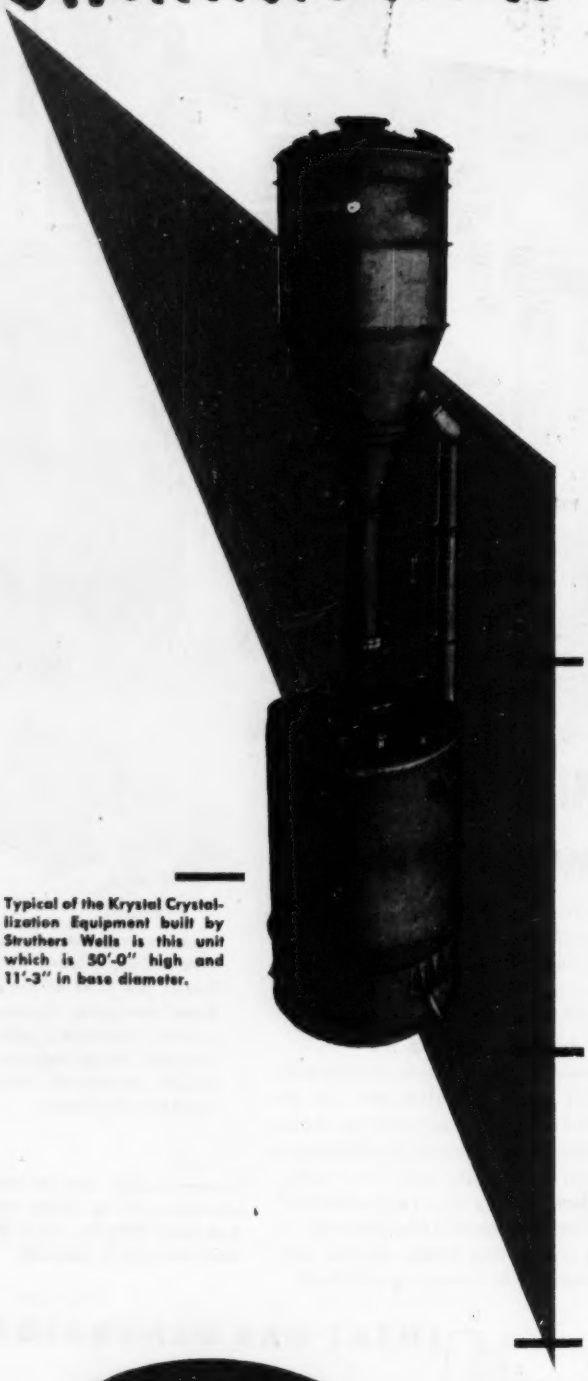


INERT GAS GENERATORS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • ADSORPTIVE DRYERS • SINGEING EQUIPMENT

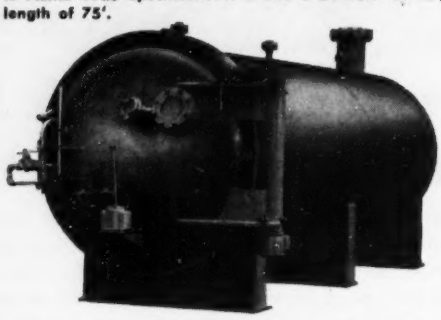
Struthers Wells.. always a dependable source for PROCESSING EQUIPMENT

Outstanding production facilities in three modern, closely-integrated plants . . . more than a century of manufacturing experience and engineering background . . . a constant eagerness to assure customer satisfaction—these factors combine to make Struthers Wells a completely dependable source for your processing equipment—any time, anywhere.

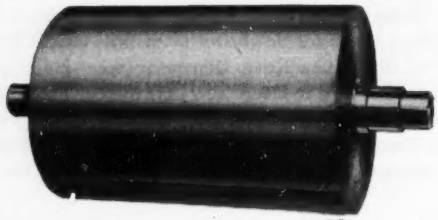


Typical of the Krystal Crystallization Equipment built by Struthers Wells is this unit which is 50'-0" high and 11'-3" in base diameter.

This Horizontal Reactor, complete with internal parts, was built to ASME Code Specifications. It has a diameter of 10', and a length of 75'.



Here is a Horizontal Impregnating Tank complete with Struthers Wells Quick Opening Door, internal track and saddles. A sight glass and explosion head are incorporated in the door design. Diameter is 6'; length is 16'.



Measuring 60" in diameter by 88" in width, this Face Vulcanizing Roll was constructed of heavy rolled plate and ends, with forged steel trunnions.

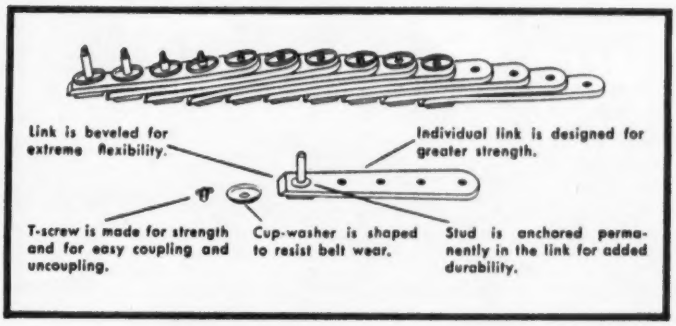
Struthers Wells

STRUTHERS WELLS CORPORATION

Processing Equipment Division • **TITUSVILLE, PA.**

Plants at Titusville, Pa. • Warren, Pa. • Offices in Principal Cities

This detailed line drawing of the new Veelos TD and TE v-belt makes it easy to see how this new v-belt is designed to do a better job... easier!


Link is beveled for extreme flexibility.
Individual link is designed for greater strength.
T-screw is made for strength and for easy coupling and uncoupling.
Cup-washer is shaped to resist belt wear.
Stud is anchored permanently in the link for added durability.

New VEELOS

TD and TE Adjustable V-Belt for D and E drives

- ***easy* to couple and install**
- **does a *better* job for a *longer* time**

THE NEW VEELOS TD AND TE adjustable v-belt was developed *specifically* for D and E drives. It's not just an adaptation, it's an entirely new patented v-belt design!

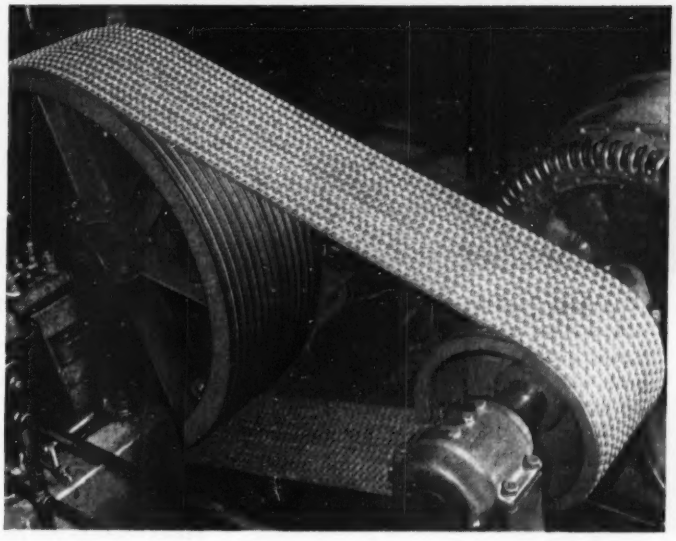
New Veelos TD and TE v-belt is faster and *easier* to install. Cup-washers and T-screws join links together to make up individual belts—and you don't need to remove outboard bearings.

New Veelos TD and TE v-belt lasts longer. Advanced construction of stud, cup-washer and T-screw provides added strength and durability—protects the new high-tensile strength link.

New Veelos TD and TE v-belt is perfectly balanced. Machine-cut sides and uniform links provide smooth, vibrationless, full-power delivery.

Put the new Veelos TD and TE v-belt on your D and E drives . . . prove to yourself that this v-belt does a better job for a longer time!

Get the complete story of this great, new v-belt. Send coupon for new 8-page illustrated bulletin.



MANHEIM MANUFACTURING & BELTING CO.
602 Manbel St., Manheim, Pa.

Please send copy of your new Veelos TD and TE v-belt catalog.

Name .....

Company .....

Address .....

.....

VEELOS
THE LINK
V-BELT

Veelos is known as Veelink outside the United States.

ADJUSTABLE TO ANY LENGTH

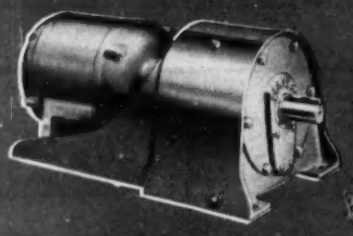
ADAPTABLE TO ANY DRIVE

T2

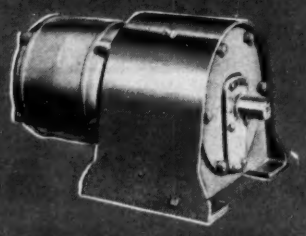
many types, sizes, styles, arrangements...

ALL-STEEL FALK Motoreducers

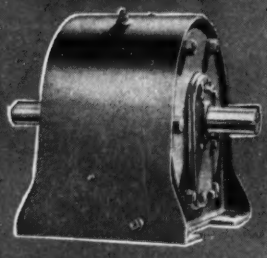
cover the entire application range



Type SZ, All-Motor Horizontal Motoreducer. Accommodates any make or type of foot-mounted motor.



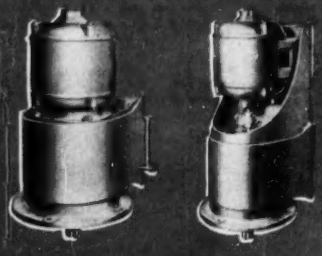
Type SF, Integral Horizontal Motoreducer. Standard NEMA D-flange motor mounts directly on Motoreducer housing.



Type SE, Concentric Shaft Speed Reducer. Coupling, chain or belt driven.

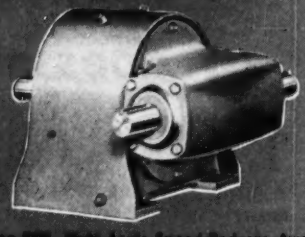
Type SRZ, All-Motor Right Angle Motoreducer. Any output shaft position (see below, right).

Type SRF, Integral Right Angle Motoreducer. Employs NEMA D-flange motor.



Type SFX, Integral Vertical Motoreducer. Employs NEMA D-flange motor.

Type SXX, All-Motor Concentric Motoreducer. For vertical applications.



Type SCR, Right Angle Speed Reducer. Any output shaft position; coupling, chain or belt driven.

VERSATILE MEMBERS OF A DISTINGUISHED FAMILY

The name FALK on a reducing unit of any size or type is your positive guarantee of highest quality, value and efficient performance with minimum maintenance throughout its long life.

All-steel FALK Motoreducers—both the All-Motor and Integral types—are available in horizontal and vertical models with double, triple or quadruple reduction; concentric and right-angle shaft arrangements. They cover a surprisingly wide range in horsepowers and in output speeds. Every FALK Motoreducer is built and rated according to AGMA standards.

Whatever your reduction requirements—be they simple, complex or "different"— it is just good business to consult FALK, recognized leader in the Motoreducer and speed reducer field. Write to Department 247.

Every FALK Motoreducer has these "IN-BUILT" Factors

All-steel Housings. Unbreakable, strong, rigid. Generous overhung load capacities provided by wide bearing spans, large shafts and bearings.

Precision Gearing. Heat-treated alloy steel, precision cut and shaved helical gearing throughout . . . quiet-operating crown shaved pinions . . . taper bored gears for easy ratio changes.

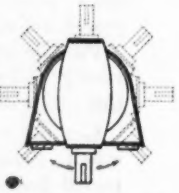
Sealed Housings. Dual closures and one-way vents keep oil in, dust and moisture out. Units are splashproof, leakproof, dustproof.

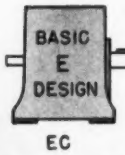
Wide Speed Range. Selective ratio combinations provide output speeds from 1.5 rpm to 1430 rpm with stock gears.

Streamlined inside and outside. Smooth, clean surfaces; machine welded construction conforms to NEMA motor frames.

Positive Lubrication. Large sump capacity . . . oil-tight construction assures clean lubricant . . . direct dip of revolving elements provides positive lubrication at all speeds.

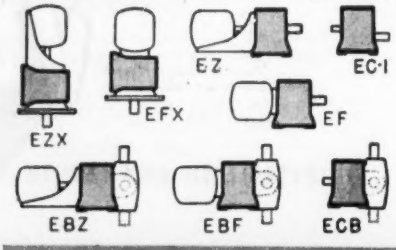
Any Output Shaft Arrangement (on Right Angle models). Shafts can be furnished in horizontal, vertical or angle position as shown in sketch at right.





EC

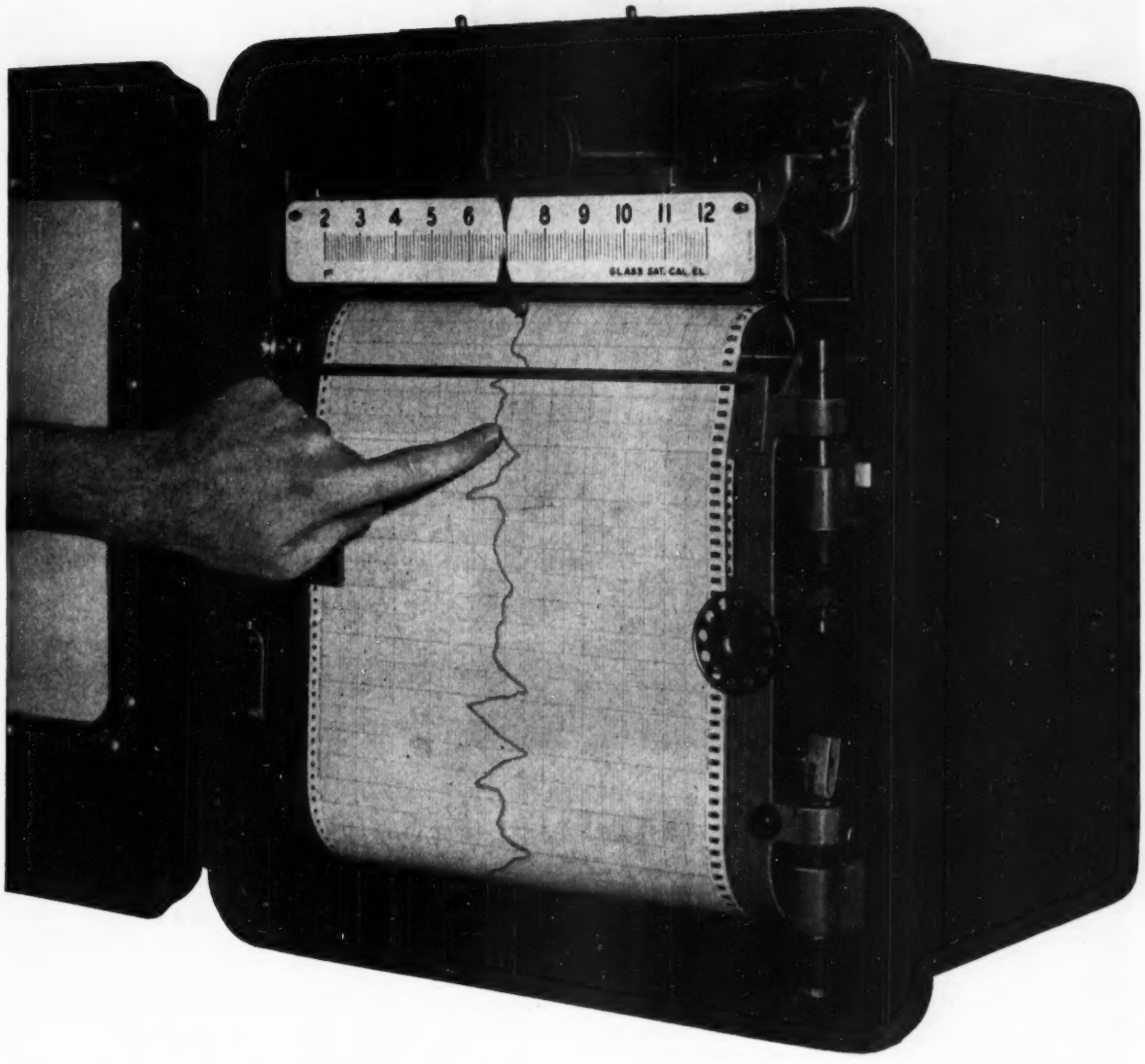
The basic E design permits maximum use of standardized parts . . . closer control over materials, processing, inspection and assembly . . . resulting in faster delivery from interchangeable stocked assemblies.



FALK ...a good name in industry

THE FALK CORPORATION, 3001 W. Canal St., Milwaukee 8, Wis.

WRITE TO DEPARTMENT 247



This is the pH record

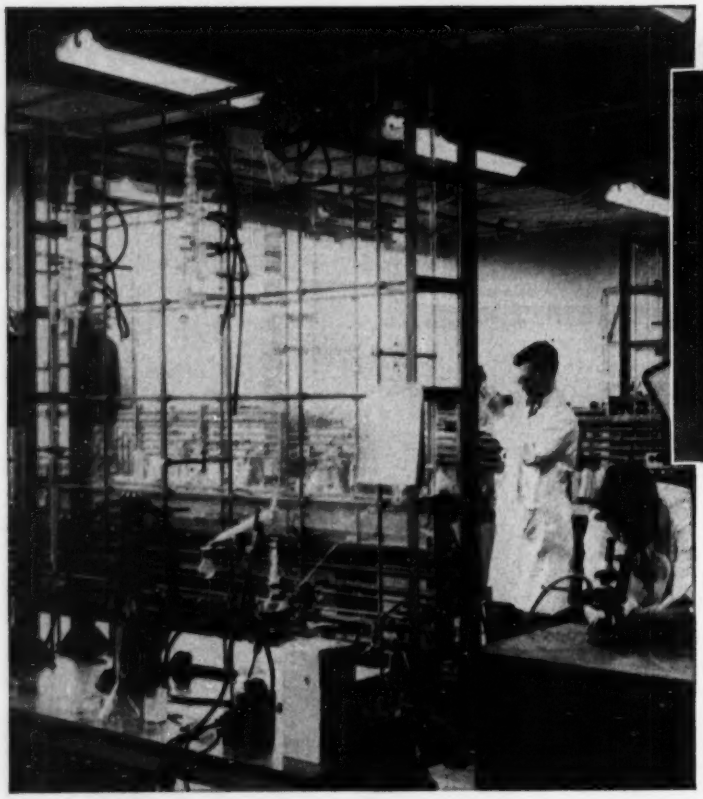
. . . being achieved by Speedomax® control on a certain neutralizing process. It didn't just "happen". When we were called in, the pH value was roaming all over the map, in spite of the best efforts of an experienced process operator. But difficult as the problem was for the user, it gave way when attacked by our scientific analysis method.

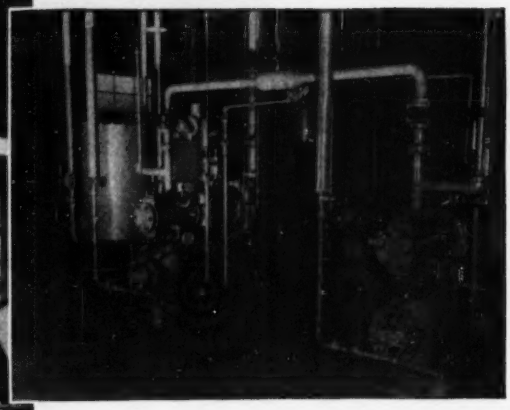
We asked the chemical engineer for specific information. Adequate facts were readily available, pertaining to the plant's raw waste, the layout and retention of the treating system, the characteristics of the neutralizing agent used. We applied our "Controllability Analysis"—proved by thousands of applications—and in less than half an hour, made our recommendations. The record speaks for itself.

The control results which we predict become *actual* results at *your* plant because complete pH equipments are a package, made and serviced by Leeds and Northrup. They include single and multiple point Speedomax recorders, pneumatic and electrical controls, highly pH-sensitive electrodes and newly designed electrode housings for practically any processing requirement.

For full particulars, send process data to Leeds and Northrup Company, 4916 Stenton Avenue, Philadelphia 44, Pennsylvania.

LEEDS NORTHRUP
instruments automatic controls • furnaces





A BWC-750 Lectrodryer dries all compressed air delivered to the various chemical, metallurgical and liquefaction research jobs at the Air Reduction Research Laboratories, Murray Hill, New Jersey.

Clean, DRY air is part of their formula at AIRCO ...

Air that's clean and DRY to a measured degree, won't upset the delicate compounding of chemicals and gases. In fact, clean DRY air is an ingredient which many times enables an experiment to succeed.

Air Reduction Research Laboratories obtain a constant supply of clean air at a preset low relative humidity by the combined use of a Lectrodryer* and Lectrofilter* installed at their air compressors. Perhaps you can benefit by a similar installation.

Lectrodryers can DRY air and gases in volume to dewpoints below −100° F. . . . can drop relative humidity lower than 10%. Lectrofilters remove dust, grime and compressor oil. These constant conditions are obtained continuously, automatically and economically.

If your research, production processes or manufacturing space require low relative humidity, learn more about types of Lectrodryers available. Write for *Because Moisture Isn't Pink,* a booklet describing the machines and how various industries use them to gain efficiency. Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liège.

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LECTRODRYER

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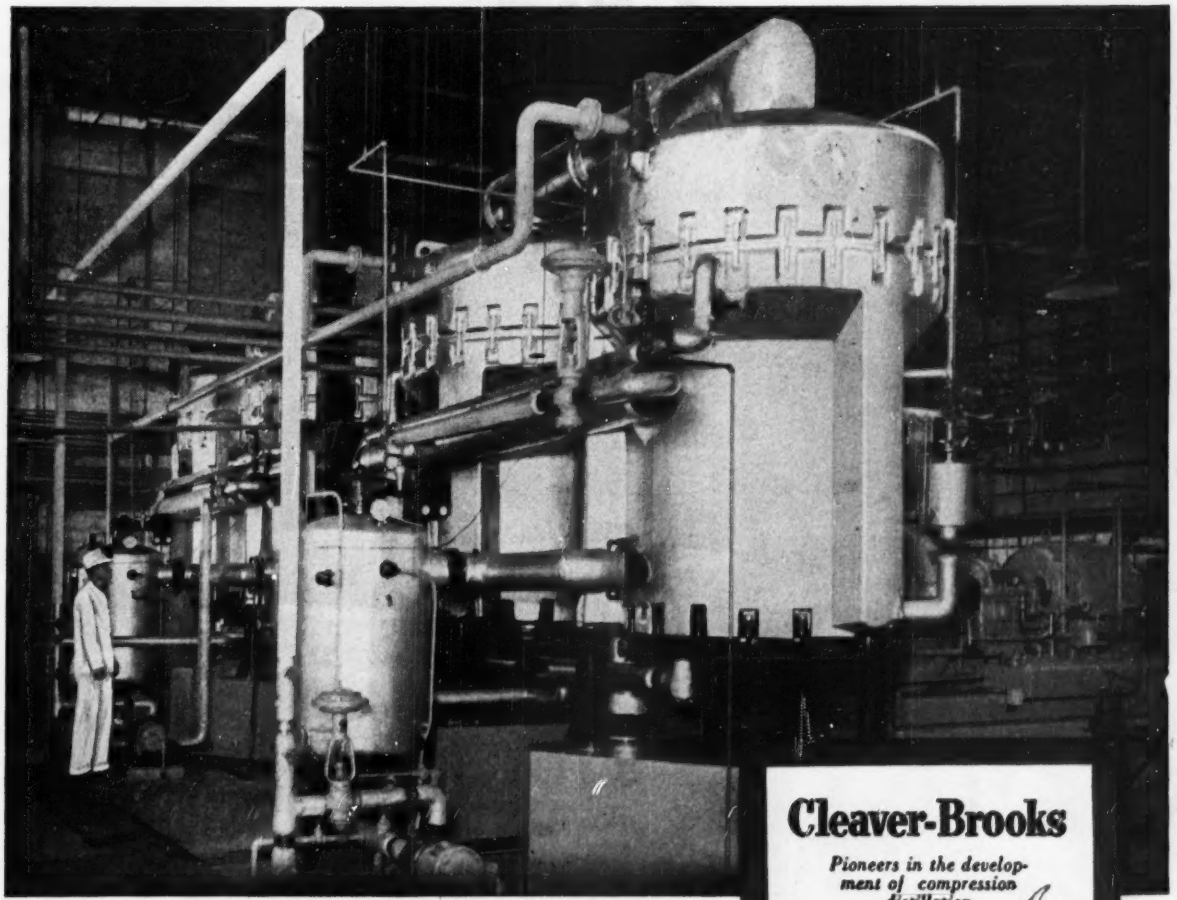
a reliable source of DISTILLED WATER OF LABORATORY QUALITY at lowest cost with CLEAVER-BROOKS compression stills

IF your process requires a supply of chemically pure water, the most reliable and economical way of providing it is to have your own source, independent of pipe lines, trucking or barging facilities.

From any water available, a Cleaver-Brooks Compression Still will give you USP chemically pure, pyrogen-free water . . . of quality far exceeding the high standards needed for chemical processing or pharmaceutical preparations.

Cleaver-Brooks Compression Stills are available in standard sizes to meet your requirements . . . from 85 gph to 2800 gph . . . motor, engine or turbine driven.

Write for latest bulletin "Compression Distillation," Cleaver-Brooks Company, Dept. F-364 E. Keefe Ave., Milwaukee 12, Wisc.



Cleaver-Brooks

Pioneers in the development of compression distillation

Cleaver-Brooks Compression Stills at Arrowhead & Puritas Waters, Inc., Los Angeles, Cal. This plant is one of the largest compression still installations in the world, producing over 100,000 gals. of pure water daily.

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil- and Gas-Fired Conversion Burners

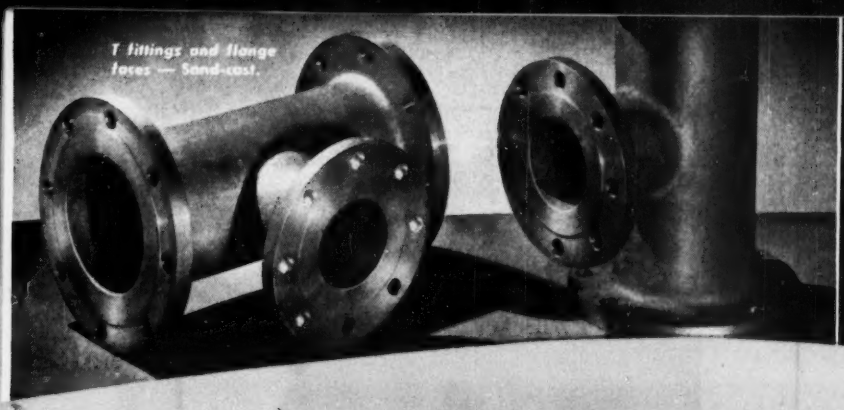
Heat Exchangers of

Downington Iron Works, Inc.

These two exchangers, fabricated by Downington Iron Works, Inc., Downington, Pa., are used in condensing benzene. Ampco Metal Tube sheets are welded to a steel shell and the heads, also made from Ampco Metal, are welded to steel flanges. All welding is done with Ampco-Trode® electrodes. Shell diameter 14". Tube length 10 feet.

The Whitlock Manufacturing Co.

This 4-pass exchanger was fabricated by The Whitlock Manufacturing Co., Hartford, Connecticut. The service is product cooling, with river water as the cooling medium. Channel cover — steel, lined with Ampco Metal Grade 8. Channel, including flanges — Ampco Metal Grade 8. Tubes — 1323 sq. ft. — ¾" OD x 16 BWG x 16'-0" Ampco Metal Grade 8. Physical construction — Whitlock Type 4-ST-4 straight tube floating head (split-ring assembly design). Shell diameter — 27 inches ID.



T fittings and flange hoses — Sand-cast.

Valve bodies — Sand-cast.

AMPCO* METAL

resist corrosion and erosion

YOU can get better service from your heat exchangers, when you use Ampco Metal for those parts that are subjected to attack by corrosion or erosion.

But heat exchangers are not the only application for Ampco Metal. You find it used in many places in the process industries and in marine service as well . . . for tanks, pipe, separators, bubble caps, fractionating towers, stills, condenser water boxes, agitators, etc. — wherever you need high resistance to corrosion and erosion.

Ampco Metal Grade 8, one of the Ampco series of engineered aluminum bronze alloys, is Boiler Code approved for unfired pressure vessels. In addition, you get these unique properties: high resistance to corrosion . . . high tensile (75,000 psi) . . . high physicals at extreme temperatures . . . high strength to weight ratio . . . high impact and fatigue values (Charpy @-423° F., 93 ft. lbs.; @ 70° F., 75 ft. lbs.; fatigue limit 28,000 lbs. @ 100,000,000 cycles) . . . high resistance to wear from erosion, abrasion, cavitation pitting . . . high compressive strength (E. L. in Comp. 25,000 psi) . . . high modulus of elasticity (18,000,000).

Moreover, Ampco Metal Grade 8 is easy to fabricate with Ampco-Trode* welding wire, rods, or covered electrodes. And, Ampco Metal Grade 8 is available in a variety of forms — sheet, plate, extrusions, pipe, tubes, fasteners, etc. Since it is the answer to many problems, it may help you. Consult your nearest Ampco Field Engineer or write us for further information.

Fabricating Ampco Metal with Inert Gas Consumable Electrode welding.

Mail this coupon today!

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Send me information on the application of Ampco Aluminum Bronzes for corrosion-resistant service in the Process Industries.

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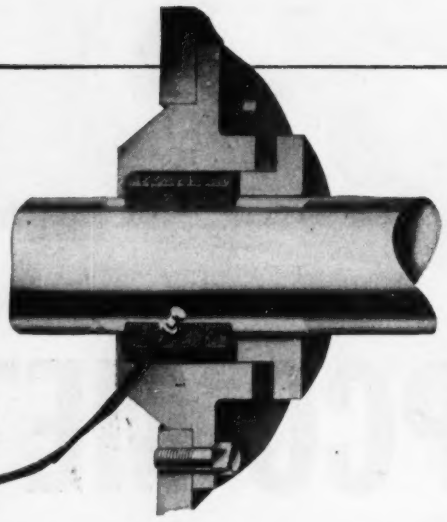
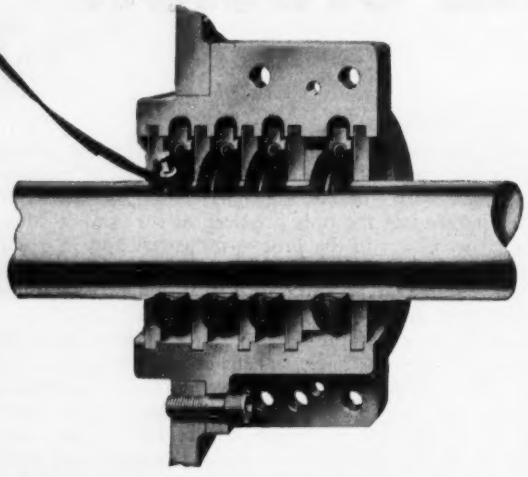
COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



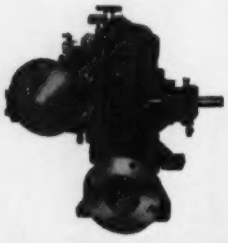
OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .



WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
225 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

Here's A **Single Source** of **Supply**

For so Many of Your Process Needs

MIXERS & AGITATORS

Types: turbine, propeller, paddle, anchor, finger, screw, ribbon, gate. **Service:** For all single or multi-phase processes involving liquids, solids, pastes and gases.

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Materials: carbon steel, the stainless steels, nickel, monel, inconel, hastalloy, clad steels. **Construction:** ASME Code

REACTORS & PROCESS UNITS

Processes: chlorination, fermentation, saponification, hydrogenation, nitration, sulfonation, polymerization, digestion, esterification, other organic syntheses. **Operations:** crystallization, heat transfer, extraction, drying, distillation, evaporation, absorption, adsorption, concentration.

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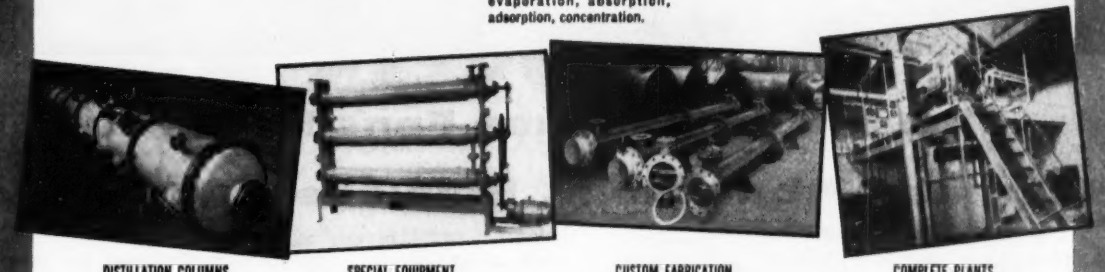
Types: shell and tube, floating head, fixed tube sheet, U-band key fittings.

EVAPORATORS

Types: forced circulation, natural circulation, multiple-effect.



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Types: bubble cap, packed, "turbogrid", special types.

SPECIAL EQUIPMENT

Like chillers, crystallizers, paste mixers, cone and ribbon blenders, post mixers, vacuum pan dryers, paint reducing tanks.

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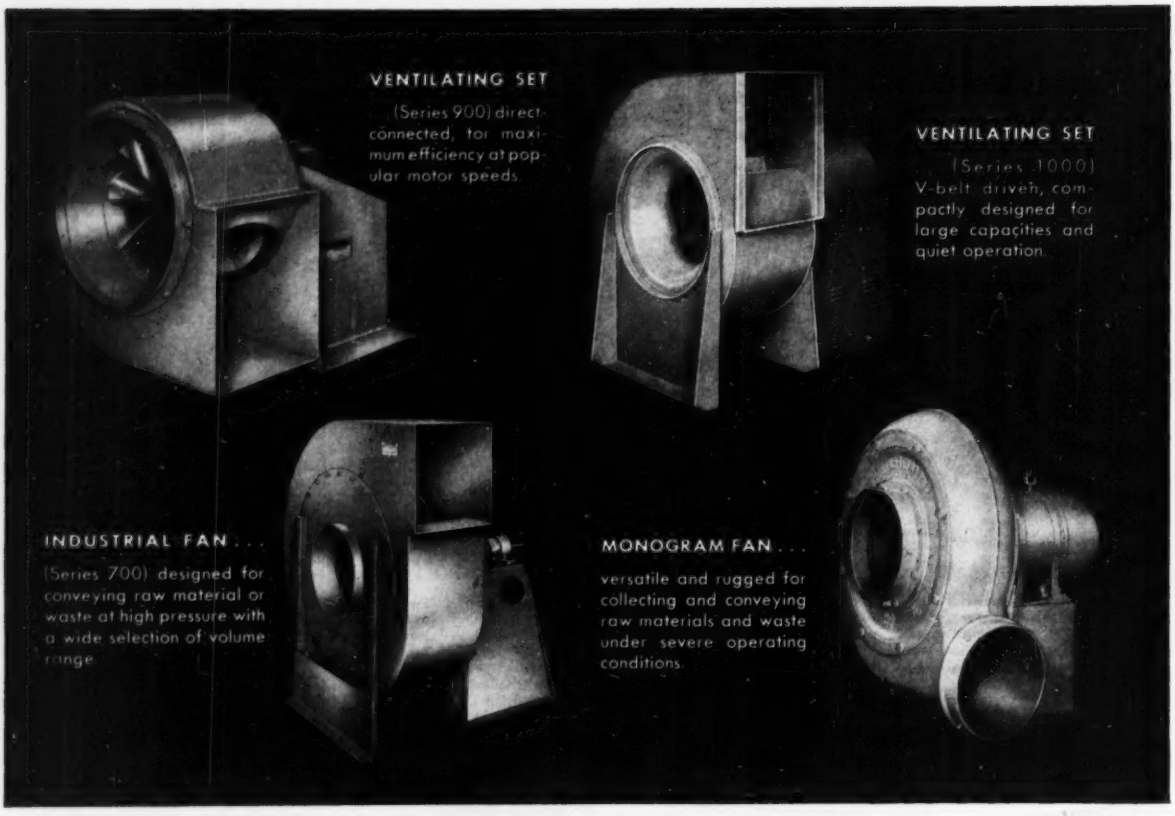

VENTILATING SET
(Series 900) direct-connected, for maximum efficiency at popular motor speeds.
VENTILATING SET
(Series 1000) V-belt driven, compactly designed for large capacities and quiet operation.
INDUSTRIAL FAN . . .
(Series 700) designed for conveying raw material or waste at high pressure with a wide selection of volume range.
MONOGRAM FAN . . .
versatile and rugged for collecting and conveying raw materials and waste under severe operating conditions.

These Westinghouse Fans Help You Increase Production...Employee Efficiency

Whatever your air handling problem . . . smoke, fumes, vapor, dust, wood shavings, granular material or ventilating . . . these Westinghouse fans are designed to handle or remove them . . . efficiently and economically.

Monogram and Industrial Fans are designed for collecting and conveying raw materials and waste . . . and permit a wide range of selections to meet the most exacting requirements.

Ventilating Sets are designed for maximum efficiency, quiet operation and low power consumption . . . for years of trouble-free operation.

Each of these rugged, powerful Westinghouse fans will prove to be the most economical solution to your specific air handling problem. And Westinghouse fans offer a *single equipment warranty* with undivided responsibility . . . an *exclusive* Westinghouse-Sturtevant feature. Get the fan built for *your* need from your nearest Westinghouse-Sturtevant office today. Or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

SERIES 900 VENTILATING SETS

Compact, efficient, direct-connected and ready-to-run. Especially suited for small ventilating installations. Radial blade wheel design minimizes problem of airborne dirt and grease. Designed for volumes to 3200 cfm.

SERIES 1000 VENTILATING SETS

V-belt driven, self-contained. Adaptable to either indoor or outdoor installations for a wide variety of heating, ventilating or air conditioning applications. Designed for volumes to 14,000 cfm. Available in sizes from 9" to 30" wheel diameters.

INDUSTRIAL FANS (SERIES 700)

Permits a wide range of volume selections at high pressure for handling and conveying raw material and waste.

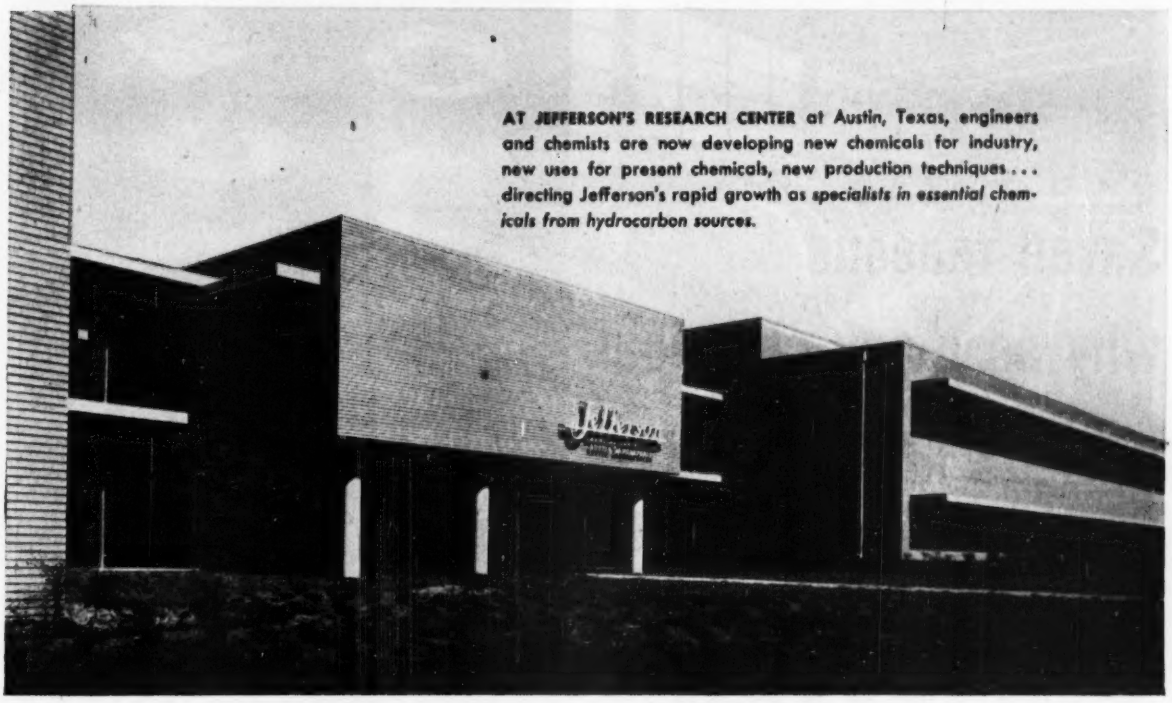
MONOGRAM FAN

Ruggedly built, many-purpose fans for use either as a blower or exhauster for dust control, collecting and conveying waste or raw materials, and supplying air for furnace blast, drying, etc. Provides long, trouble-free service at low cost under severest operating conditions. Available in ten sizes with capacities from 200 to 13,500 cfm . . . pressures from 1" to 12" wg.

WESTINGHOUSE AIR HANDLING

J-60380

YOU CAN BE SURE ... IF IT'S Westinghouse



AT JEFFERSON'S RESEARCH CENTER at Austin, Texas, engineers and chemists are now developing new chemicals for industry, new uses for present chemicals, new production techniques . . . directing Jefferson's rapid growth as *specialists in essential chemicals from hydrocarbon sources.*

To help you in your search for

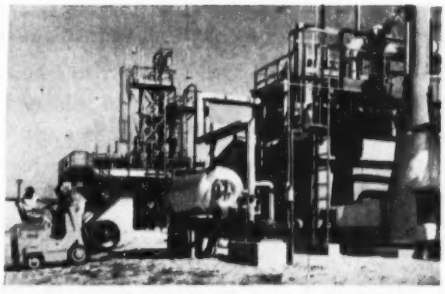
NEW PETROCHEMICALS

to expand your markets, increase your profits

If you are looking for new or improved petrochemicals to build future markets then make a note of this:

First, Jefferson's modern, recently expanded research and pilot plant facilities at Austin, Texas, are now in full operation.

Second, one of their main objectives is to develop new and improved Jefferson Chemicals for use throughout industry . . . the chemicals you need to step up your sales, create new products, cut your costs of production.



At Jefferson's experimental production unit, also located at Austin, greater quantities of new chemicals are being produced to meet your exacting demands.

Your nearest Jefferson representative will be happy to assist you with your petrochemical applications.

CHEMICAL PROGRESS WEEK-MAY 17-23

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CHEMICAL COMPANY, INC.
260 MADISON AVENUE, NEW YORK 16, N. Y.

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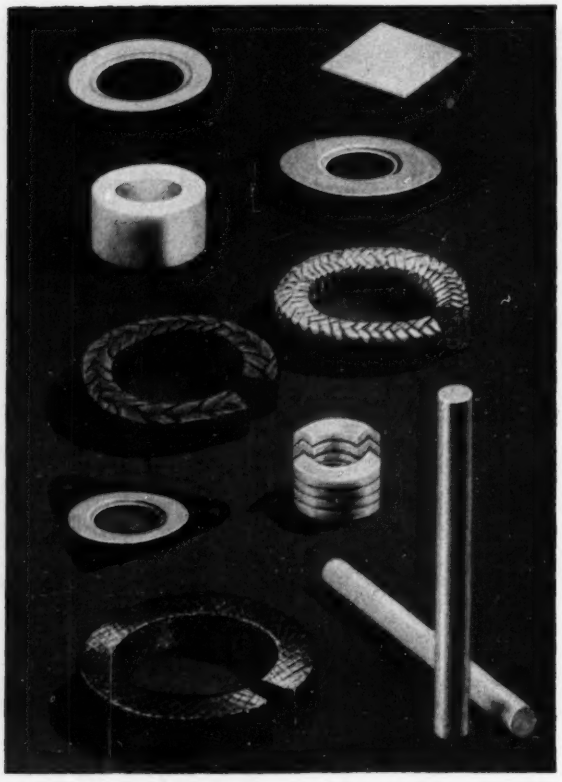
Ethylene Glycol
Ethylene Dichloride
Diethylene Glycol
Monoethanolamine
Diethanolamine
Triethanolamine
Nonyl Phenol
Morpholine
Ethylene Carbonate
Propylene Carbonate
Polyethylene Glycols
Glycol Ethers

Seven reasons why so many chemical packing problems are being solved by R/M Teflon*



1. **"TEFLON" is not affected by chemicals within the temperature range of −80°F. to 500°F.**
2. **"TEFLON" has high heat stability.**
3. **"TEFLON" has excellent nonadhesive properties.**
4. **"TEFLON" is nonflammable.**
5. **"TEFLON" possesses excellent electrical properties.**
6. **"TEFLON'S" water absorption is zero.**
7. **Weather does not affect "TEFLON".**

These seven unique properties make "TEFLON" an ideal packing and gasket material for the chemical industry. Raybestos-Manhattan's "TEFLON" Packings and Gaskets are available in a variety of combinations for glass, glass-lined and stainless steel piping, and for pumps, valves and practically all kinds of fluid-handling equipment. Included in the line are solid rings; Vee-Flex® rings; braided and plastic packings for stuffing boxes and valve stems; "envelope" gaskets; solid gaskets in round, square and irregular shapes; gaskets for handholes, manholes and flanges; gaskets for distillation columns; gaskets for covers on tanks, kettles and autoclaves; gaskets for flanges and nozzles on glass and glass-lined pipe. Into each goes a know-how of 50 years' packing experience.

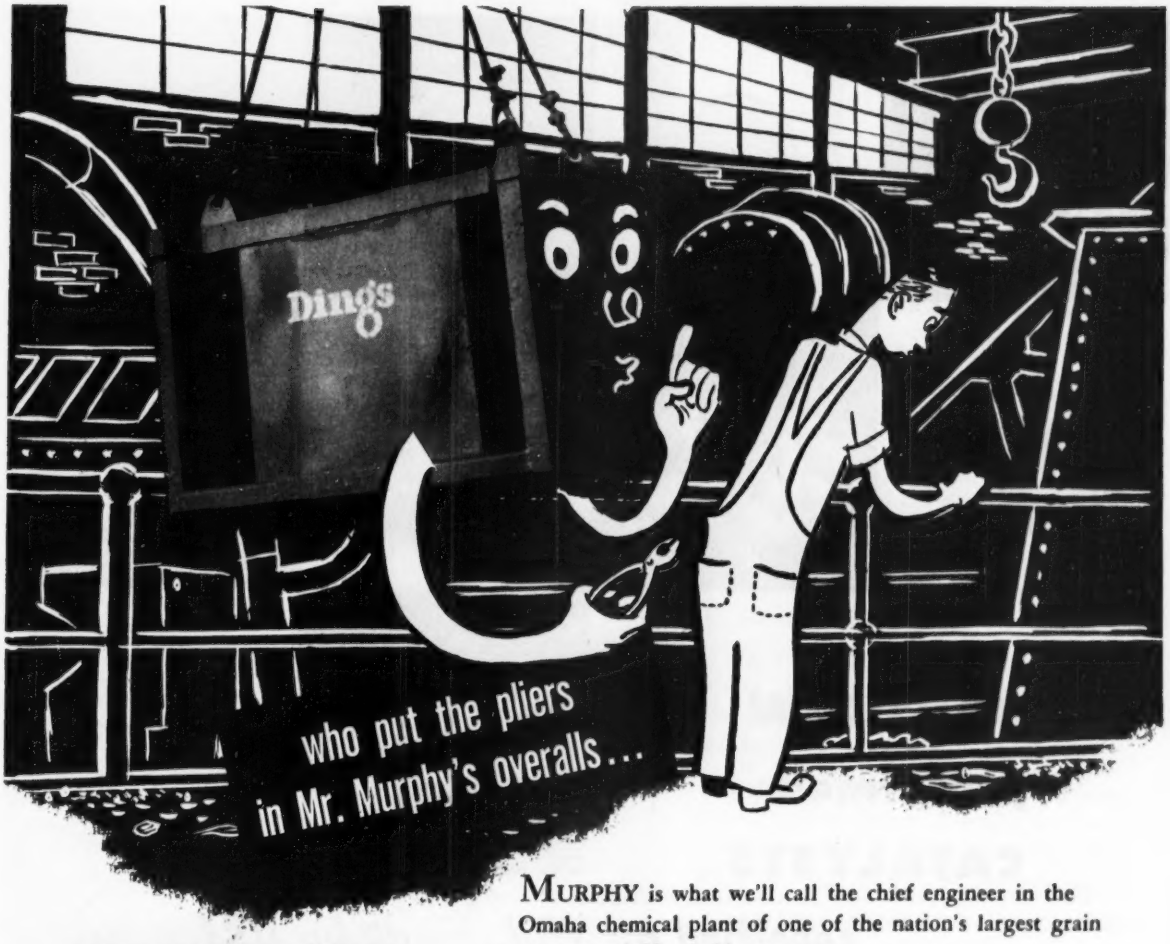
**Du Pont's trade-mark for its tetrafluoroethylene resin*

DO YOU FABRICATE YOUR OWN PARTS?
If so, order R/M "TEFLON" in sheets, rods or tubes to your specifications.

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C. Crawfordsville Ind.; Passaic, N.J. Neenah, Wis., Peterborough, Ontario.

RAYBESTOS-MANHATTAN, INC. Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts Radiator Hose • Bowling Balls

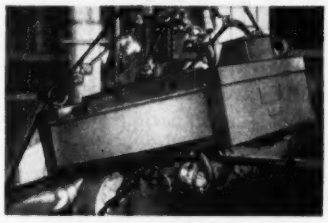


MURPHY is what we'll call the chief engineer in the Omaha chemical plant of one of the nation's largest grain processors.* Here's his story —

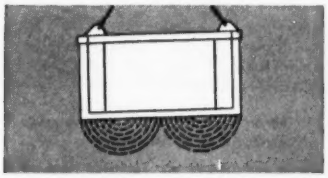
One day, not long after his Dings RM Suspended Tramp Iron Magnet was installed, he was wishing he had a pair of long nosed pliers. Shortly after, one of his men walked up and handed him a pair. They'd been pulled out of a 12-inch conveyor belt burden of corncobs by the Dings RM Magnet.

Murphy was awfully glad to see those pliers and not just because he wanted a pair. He was thinking of what they would have done to the hammermills and other processing equipment fed by that conveyor, if they hadn't been caught by the Dings Magnet.

You might think about that, too. What's it costing you to "process" tramp iron in your plant? It isn't necessary. Your Dings representative can show you an economical way to eliminate tramp iron with a Dings Magnetic Separator.



THIS IS THE MAGNET THAT CAUGHT THE PLIERS — That junk on the bottom is a typical tramp iron accumulation— crushed "tin" cans, wire. "Murphy" reports even crowbars occasionally find their way into the corncobs processed in his plant.



HERE'S HOW IT WORKS — The Dings RM Magnet can be suspended over conveyor belts, installed on chutes or liquid lines. There isn't a more powerful tramp iron magnet than this triple-poled unit. Its field is deeper and longer, and it's available in a complete range of sizes and magnetic strengths. Complete details in Catalog 1315-A.

*Name and complete details on request

DINGS MAGNETIC SEPARATOR COMPANY

4730 W. Electric Ave., Milwaukee 46, Wis.

RM-154

Dings

HARSHAW preformed CATALYSTS

specified by YOU...made by US!

Harshaw manufactures to specification dozens of catalysts for many different and complex manufacturing processes. The experience of more than fifteen years in helping to solve a great number of individual catalyst problems places us in a most helpful position, either in the development of the best and most economical catalyst, or in qualifying with large production capacity requirements. If you have a problem, perhaps a discussion with us will prove helpful.

SEND FOR *this 8-page booklet on Harshaw Catalysts*

PROCESS

Hydroforming	Cyclization	Oxidation
Dehydrogenation	Dehydration	Desulphurization
Alkylation	Isomerization	Hydrogenation

TYPICAL CATALYSTS

Aluminum Chloride Anhydrous — Boron Fluoride Addition Compounds
Boron Trifluoride — Hydrofluoric Acid Anhydrous

Alumina — Chrome Alumina — Molybdena Alumina — Tungsten Alumina
Cobalt — Copper — Magnesia — Mercury — Nickel — Vanadium

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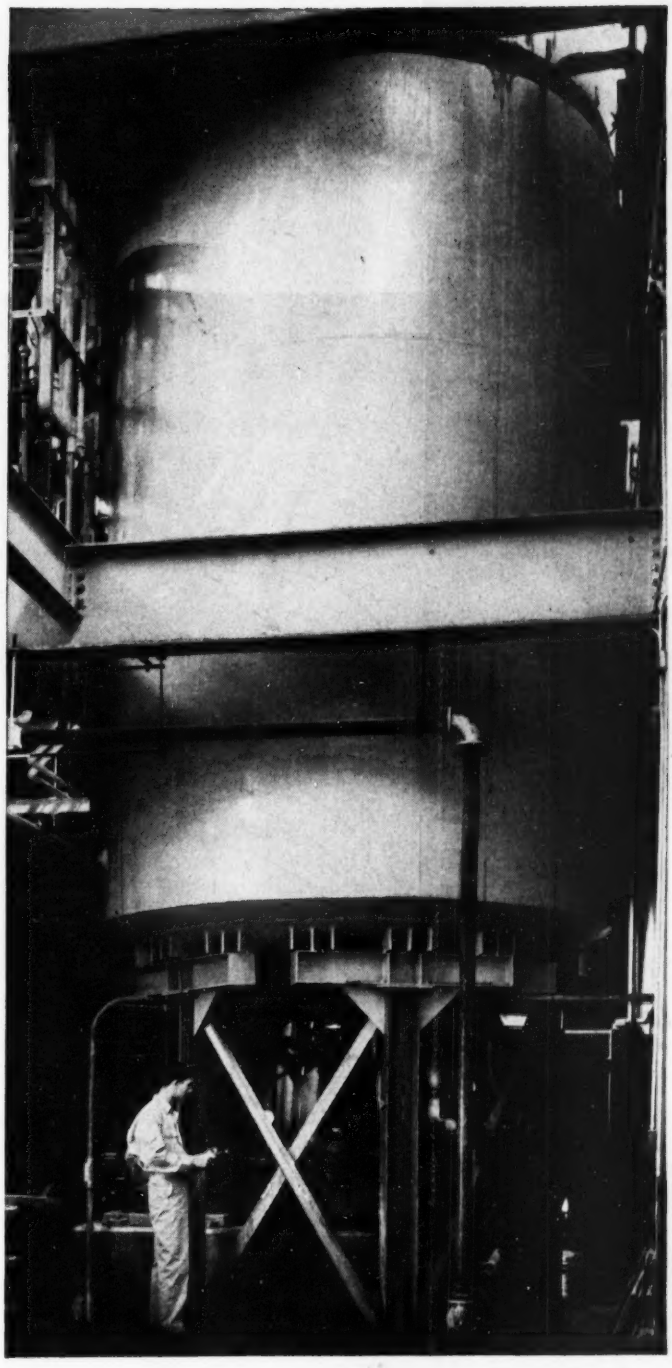


Keeping penicillin pure

may hold an idea for you

A pharmaceutical manufacturer formerly made penicillin in steel fermentation tanks. The problem was: how to keep the delicate organisms from being poisoned by the metal?

The answer: the 10,000 gallon tank shown above made of Enduro Stainless Steel. Enduro has no effect on penicillin organisms.

But the manufacturer also found extra advantages in Enduro. Like higher resistance to corrosion. Easy cleanability. Easy sterilization. And low maintenance costs.

No matter which of Enduro's properties you want most, you get the extra ones automatically. For no other commercial metal has the unique combination of physical and chemical properties you find in Enduro Stainless Steel. Republic will be glad to help you use them where they will do the most good. Write to:

REPUBLIC STEEL CORPORATION
Alloy Steel Division · Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

REPUBLIC STEEL

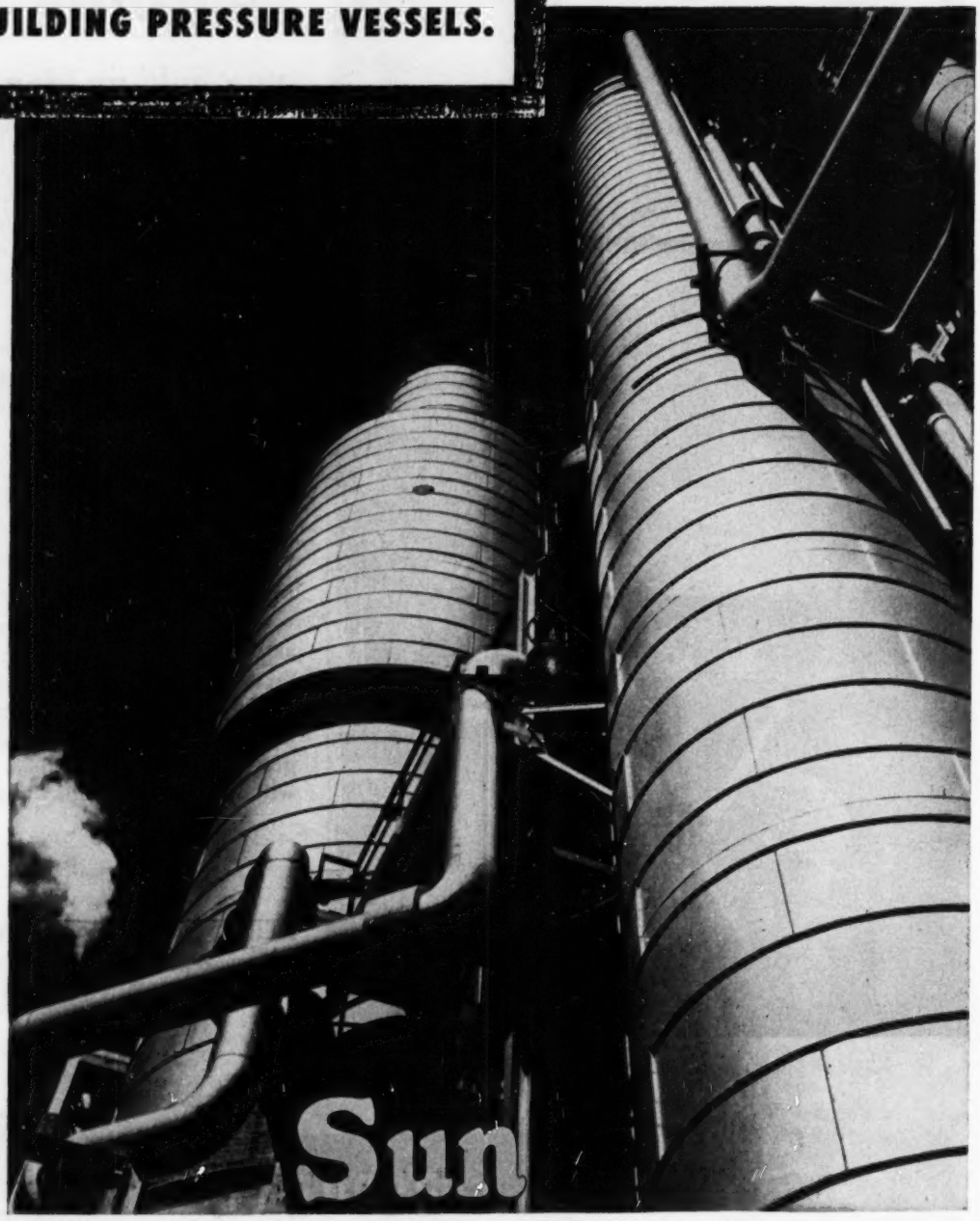
REPUBLIC ENDURO STAINLESS STEEL

Other Republic Products include Carbon and Alloy Steels — Titanium — Steel and Plastic Pipe, Bolts and Nuts, Tubing, Barrels and Drums

Monuments

TO SUN SHIP'S ACHIEVEMENTS

IN BUILDING PRESSURE VESSELS.



SHIPBUILDING & DRY DOCK COMPANY

SINCE 1916

ON THE DELAWARE • CHESTER, PA.

25 BROADWAY • NEW YORK CITY

Built for SEVERE DUTY

frequent starting • inching • reversing • dynamic braking

ALLIS-CHALMERS
Type 256
AIR CONTACTOR
FOR 2300 TO 5000-VOLT MOTOR CONTROL

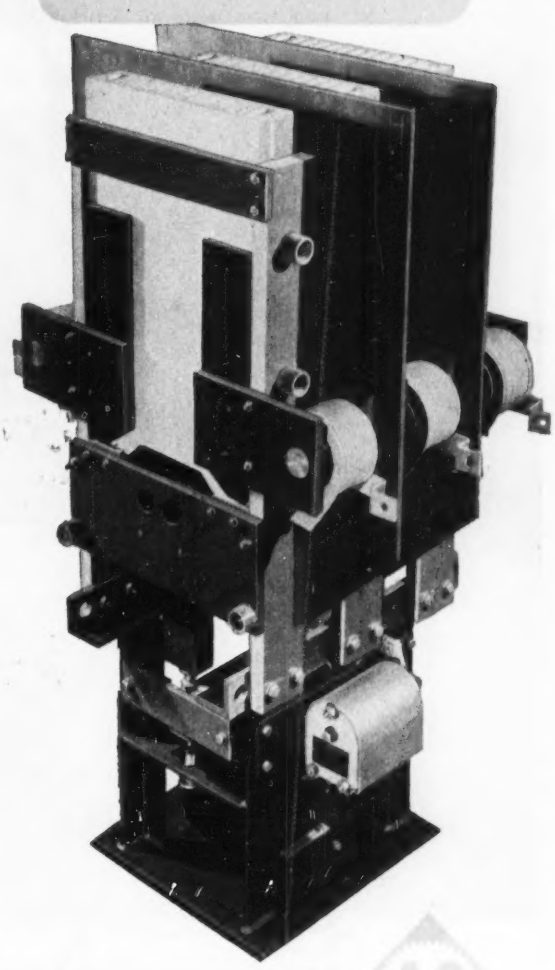
Durability and long-term dependability were given prime consideration in the design of the Allis-Chalmers Type 256 air-break contactor. As a result, the roughest repetitive duty becomes routine — contact operations are actually numbered in the millions with a minimum of servicing.

DESIGN FEATURES

By utilizing a simple vertical motion and double break contacts, troublesome maintenance factors, such as mechanical linkages, turning shafts, shaft bearings and flexible leads, have been eliminated. From the operation standpoint, two gaps in series cut arc voltage in half. Rapid arc extinction is further facilitated by magnetic blowouts at each gap, operating with arc chutes designed to take full advantage of dual blowouts.

In Allis-Chalmers Type H high voltage starters, Type 256 air-break contactors — along with meters, overload relays, current limiting fuses, auxiliary switches — are coordinated to meet heavy duty demands — to provide high capacity interruption and complete protection for man, motor and machine. For complete information see your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for bulletins 14B6410B and 14B7303.

A-4325



ALLIS-CHALMERS

Lester B. Pope, Managing Editor of CHEMICAL ENGINEERING

YOUR IDEA!

. . . come off it now, Pope*

Who's he kidding? This "Inventory Issue" was sparked by CHEMICAL ENGINEERING's readers—and Managing Editor Pope knows it. Guess he just feels good on general principles.

"You're right! I do feel good...the format's a natural on this issue and the content is just what you readers ordered.

Sure you did! I've seen your comments in the reader opinion surveys for months *(Editor Callaham polls 1000-a-month, you know)*—your letters requested an 'Inventory Issue'—we've triple-checked your preferences with personal interviews in the field. How can it miss? *It's tailor-made to your own specifications.*

Take theme and content. The 'What's New' slant will cover every top-flight trend and development in chemical processing for a whole year. It'll include... *new plants and facilities—new processes and technology—new equipment and accessories—new chemicals and materials.* And you can throw away that old file of catalogs and bulletins because there's a complete *manufacturer's literature library* on the way—plus a span-new method for indexing *Reader Service* covering every product advertised or mentioned editorially in the issue.

But let's get back to format for a second. You'll like it because everything's being done to make this a usable, easily scanned and highly readable handbook. Logical organization, arrangement and physical appearance get peak priority. Copy is tightly written and thoroughly descriptive. It's simplified and streamlined from masthead to Reader Service postcard.

And by the way... if you're reading this in somebody else's copy, why not write us now about a regular CE subscription. That's the only way you'll get maximum use from this 'Annual Inventory Issue'—*get one all your own!*

Be talking to you again soon. Look for more on this big 'dividend edition' in CE next month." *Lester B. Pope,* Managing Editor.

more engineering-minded men read it . . .

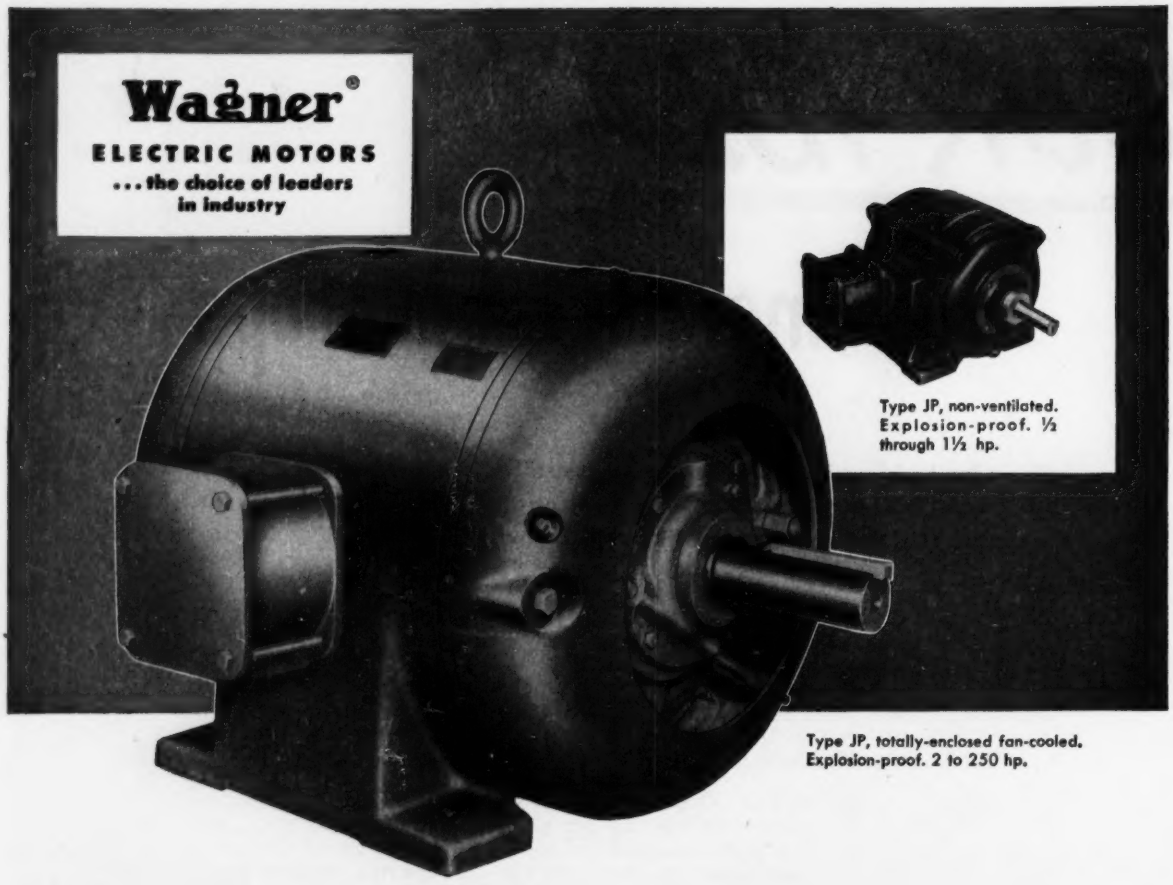
more chemical engineers profit from it . . .

Chemical Engineering

A McGRAW-HILL PUBLICATION

330 WEST 42nd ST., NEW YORK 36, N.Y.

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry



Type JP, non-ventilated. Explosion-proof. ½ through 1½ hp.

Type JP, totally-enclosed fan-cooled. Explosion-proof. 2 to 250 hp.

for extra protection against corrosion

SPECIFY Wagner CAST IRON FRAME MOTORS

Here are stock motors specifically designed for use in chemical plants, oil fields, refineries, steel mills—for rugged industrial applications where dust, dirt, moisture, or corrosive vapors are present.

These motors are totally-enclosed in corrosion-resistant cast iron and all parts exposed to the atmosphere are of corrosion-resistant material—including the nameplate. They feature completely protected laminations... special varnish treated windings... and a running shaft seal.

Wagner Cast Iron Frame Motors are available in fan-cooled standard and explosion-proof types in ratings from 2 to 250 hp, and in non-ventilated standard and explosion-proof types in ratings from ½ through 1½ hp. Wagner Bulletin MU-132 gives complete information.

A skilled Wagner engineer can help you select a Wagner Motor to meet your most exacting specifications. Call the nearest of our 32 branch offices, or write us.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6407 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

MU-9

For value in full measure

Value is measured not only in quality and uniformity but in service as well. You get full value in all three when you use Nialk chemicals.

for instance...

NIALK CARBONATE OF POTASH: Superior solubility and lubricating properties, plus highest uniformity, make NIALK Carbonate of Potash ideal as a dye extender in printing pastes for the finest of printed fabrics.

The value to industry of this and other NIALK products is created not only through constant research and strict quality control but also through fast, safe delivery and close attention to industry's needs.

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LIQUID CHLORINE
CAUSTIC POTASH
CARBONATE OF POTASH
PARADICHLOROBENZENE
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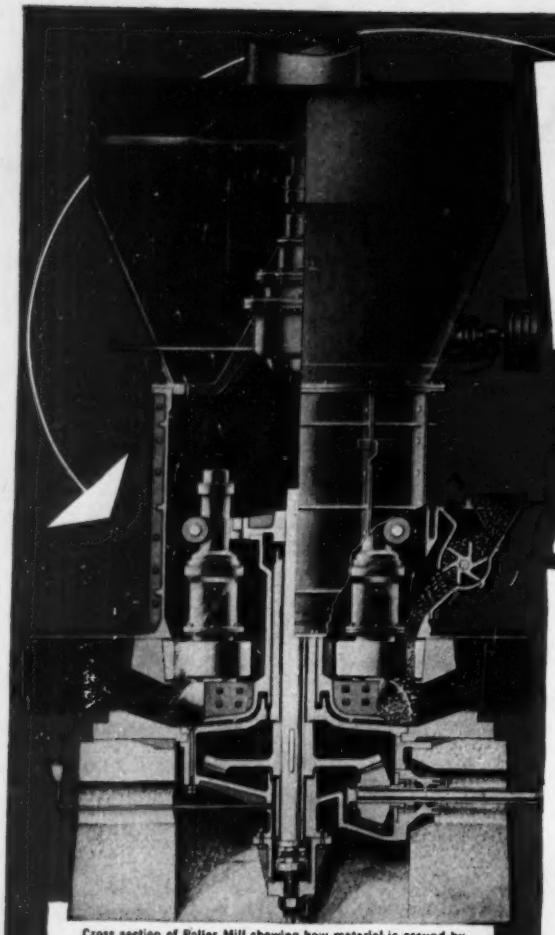
TRICHLORethylene

NIAGATHAL (TETRACHLORO PHTHALIC ANHYDRIDE)

Increase Your Output Of FINE GRINDING

...with greater uniformity
...at lower cost

WILLIAMS Roller Mills



Cross section of Roller Mill showing how material is ground by rolls rotating against bull ring, then air swept to separator which extracts fines and returns coarse material to mill for regrinding.

Insecticide formulas, pigments and dry colors, barytes, phosphate, limestone—whatever the material, if it has to be finely ground, there's a Williams Roller Mill to do it—faster, for stepped up production—more accurately and uniformly—and at far less cost!

Automatic and continuous in operation, the Williams also dries and grinds simultaneously. Instantly adjustable for finenesses of 20 to 400 mesh, even down to micron sizes. No built-up cushions of "fines" can impair grinding efficiency because the constant upward air current carries ground materials to the air separator which discharges *all* finished materials and returns *only* the oversize product to the mill for further grinding.

Feeding rate is automatic and self-adjusting, positive and simple in action—Anti-friction roller and ball bearings reduce down-time for lubrication, save oil and put more power into grinding—Take-up for wear is continuous and automatic—Rugged forgings, electric steel and alloy castings guard against wear and breakdowns—These and many other outstanding features have made Williams Roller Mills the standard for fine-grinding operations.

Write For Catalog

OTHER WILLIAMS EQUIPMENT

HAMMER MILLS

Heavy duty construction in many sizes for crushing and grinding to small size, in one operation, phosphate, gypsum, limestone, shale, bauxite, asbestos rock and virtually all other chemical and fibrous materials.

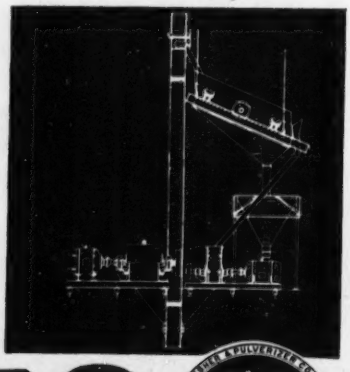
HELIX-SEAL HAMMER MILLS

Dust-free fine grinding, 100 to 325 mesh, without fans, cyclones or air separators. Variable speed feed control. Will also handle wet, sticky, oily and greasy materials without clogging. Easy to install; inexpensive to operate.

IMPACT and DRIER MILLS
AIR SEPARATORS
VIBRATING SCREENS

WILLIAMS COMPLETE PLANTS

Backed by years of know-how and experience, Williams can build any type of ready-to-install plant to handle crushing, grinding, air separation, sifting, conveying and magnetic separation including storage bins and electrical equipment.



WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. 9th ST. ☆ ST. LOUIS 6, MO.

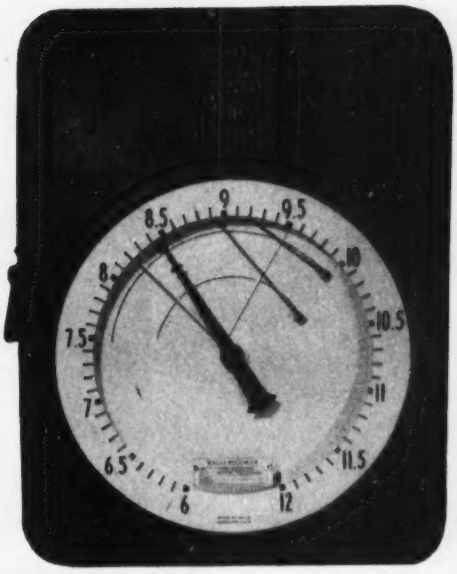
WILLIAMS

CRUSHERS GRINDERS SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

PYROTRON by BAILEY...

Your best buy for Precision Temperature Measurements In the -300F to 1200F Range



Check These Exclusive Bailey Advantages of Resistance Thermometer Operation

✓ Resistance thermometer operation over a complete range from —300F to 1200F has been made possible by Bailey's development of a low-cost platinum resistance element.

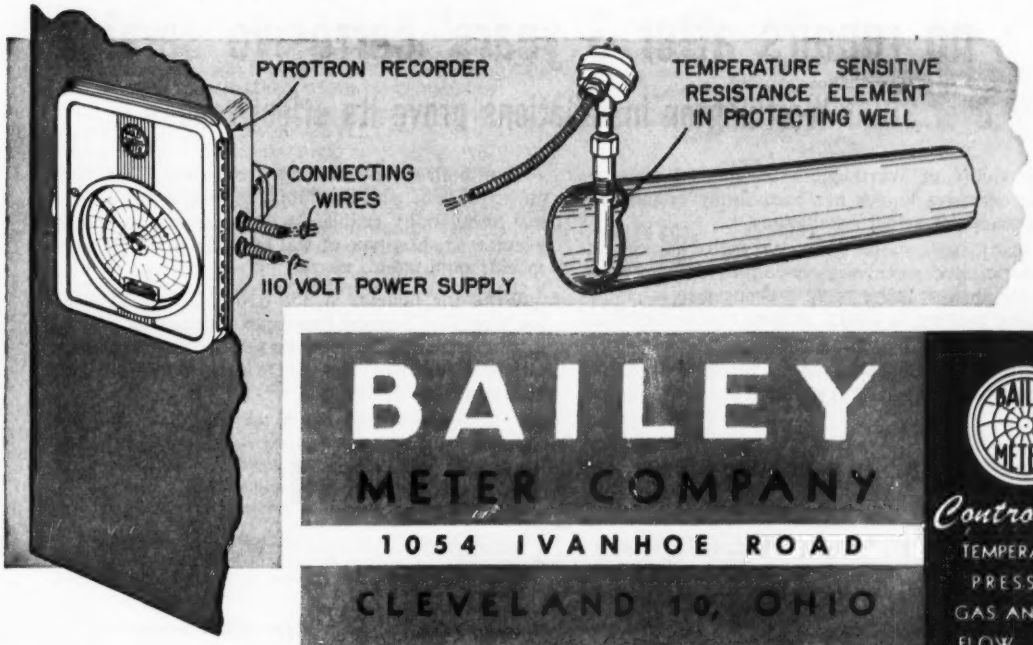
✓ Resistance thermometer operation requires no standard cell, dry battery and cold junction compensator. Uses 115 volt a-c source. Strong signal and high precision of resistance element as compared to thermocouple makes possible the use of narrow range spans.

✓ The Bailey Pyrotron is calibrated at the factory and *remains* accurate; no periodic re-calibrations required. Since all elements are matched it is not necessary to calibrate each recorder to its element.

✓ Recorder is sensitive to 1/10 of 1% of range span.

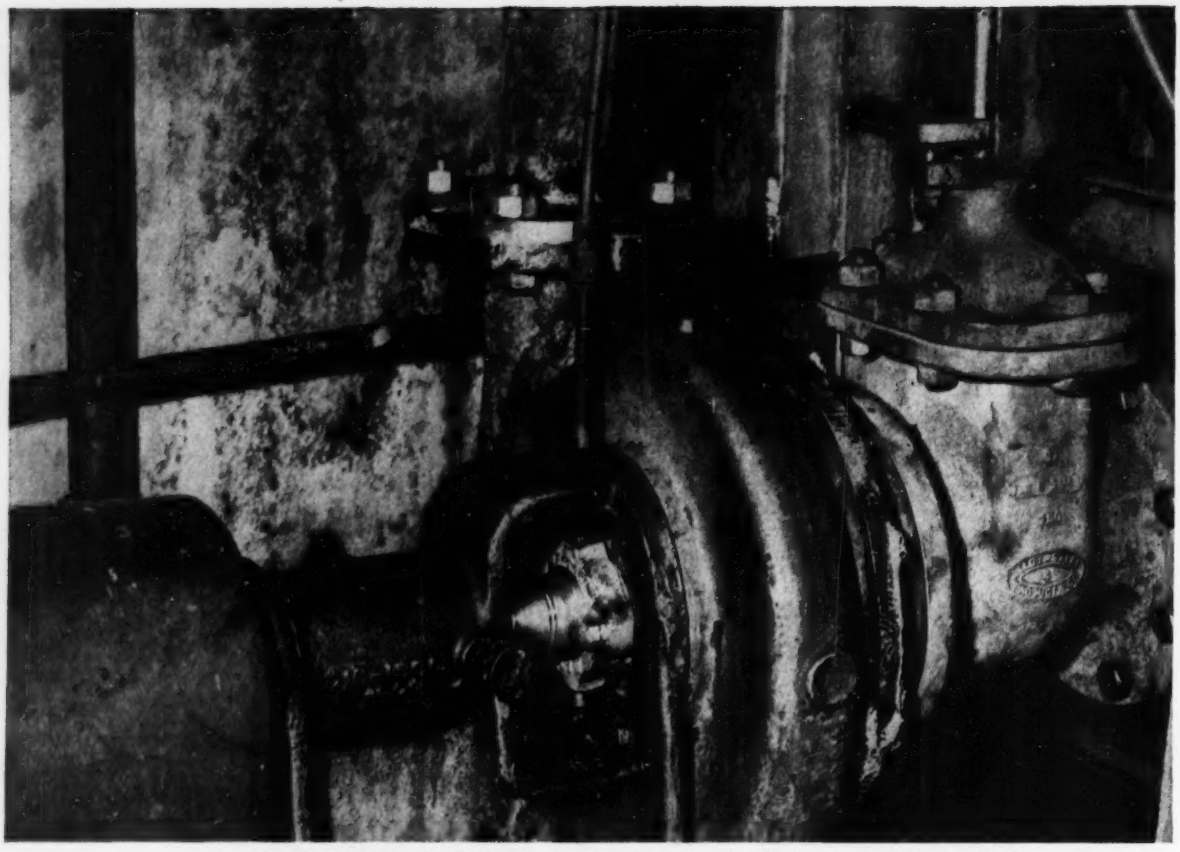
✓ Ordinary copper lead wires permit remote location of recorder with respect to the temperature sensing element.

✓ For complete information, write for bulletin 230-C on the Bailey Pyrotron Electronic Resistance Thermometer. P-27-1



BAILEY METER COMPANY
1054 IVANHOE ROAD
CLEVELAND 10, OHIO
Complete Controls for Process Plants

BAILEY METERS
Controls for
TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW LEVEL
RATIO



WORTHITE CHEMICAL PUMP WITH MECHANICAL SEAL handles hot copper sulphate solution used by Scovill Manufacturing Co., for pickling brass. Note water connection for preventing formation of crystals.

Mechanical seal on Worthite pump needs no repairs after 3 years' corrosive service

Over 3000 Worthington installations prove its effectiveness

The ability of Worthington mechanical seals to handle corrosive liquids has been firmly established by thousands of actual installations.

In many applications where leakage or packing is a problem, mechanical seals have proven themselves to be the answer. If the pump is changed to a service requiring packing, a simple adapter can be installed and packed in the normal manner.

Worthington can supply either a mechanical seal or conventional stuffing box as standard pump equipment — with both readily available from stock. This, plus our experience with over 3000 successful mechanical seal installations, enables us to advise our customers which is the best type of seal or stuffing box for each specific application.

Write for bulletin W-350-B16, Mechanical Seals for Worthite Chemical Pumps, to your nearest Worthington district office. Or write to Worthington Corporation, Centrifugal Pump Division, Section C.3.8, Harrison, New Jersey.

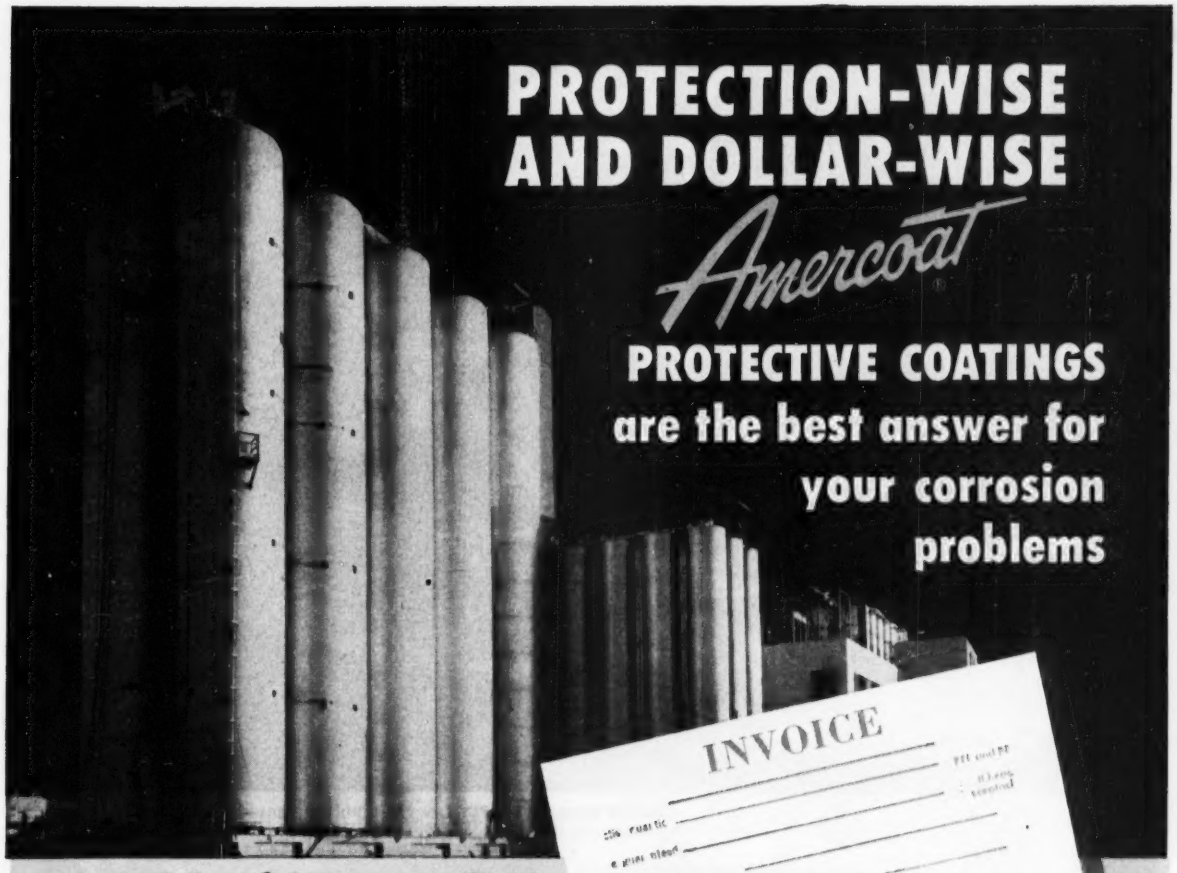
C.3.8

WORTHINGTON

Type CNG Worthite Chemical Pump — Sizes ¾ to 6". Capacities to 2000 gpm; heads to 200 ft.

Type CNP Haveg Chemical Pump — Size 1½". Capacities to 160 gpm; heads to 70 ft.

Type KEB Worthite Propeller Pump — Sizes 8 to 24". Capacities to 19,500 gpm; heads to 20 ft.



PROTECTION-WISE AND DOLLAR-WISE

Amercoat

PROTECTIVE COATINGS are the best answer for your corrosion problems

INVOICE

No Charge

because *you receive these extra values at no extra cost every time you specify Amercoat*

1. Assurance of the best recommendation for your specific coating problems—Amercoat provides the most complete line of protective coatings available to industry.

2. Technical assistance backed by the most experienced organization SPECIALIZING in corrosion-resistant coatings.

There's a big difference between just buying paints or coatings and buying protection from corrosion. When you buy Amercoat, you're sure to receive corrosion protection because Amercoat specializes in corrosion control. Amercoat produces protective coatings exclusively, and has developed the most complete line of protective coatings available to industry.

At Amercoat, we know from experience in every major industry that corrosion can't be licked with so-called "all purpose" paints and coatings or with haphazard coating selection and application methods. It takes careful analysis of the specific exposure problem—it takes the proper selection of a coating with specific properties to resist the exposure, and it takes attention to surface preparation and application details so that the coating can do its job properly.

You can be sure when you specify Amercoat that you will receive the most suitable coating for your specific problem. Equally important, but at no extra cost, you receive many added benefits that assure you of maximum protection. An Amercoat representative gives you the full benefit of his experience.

He carefully analyzes your complete problem.

He determines the particular coating that will best solve your problem.

And he gives complete on-the-spot advice regarding surface preparation and application procedures.

That's why protection-wise–and dollar-wise, Amercoat is consistently your best coating specification. Investigate Amercoat now. There's a representative near you to assist you.

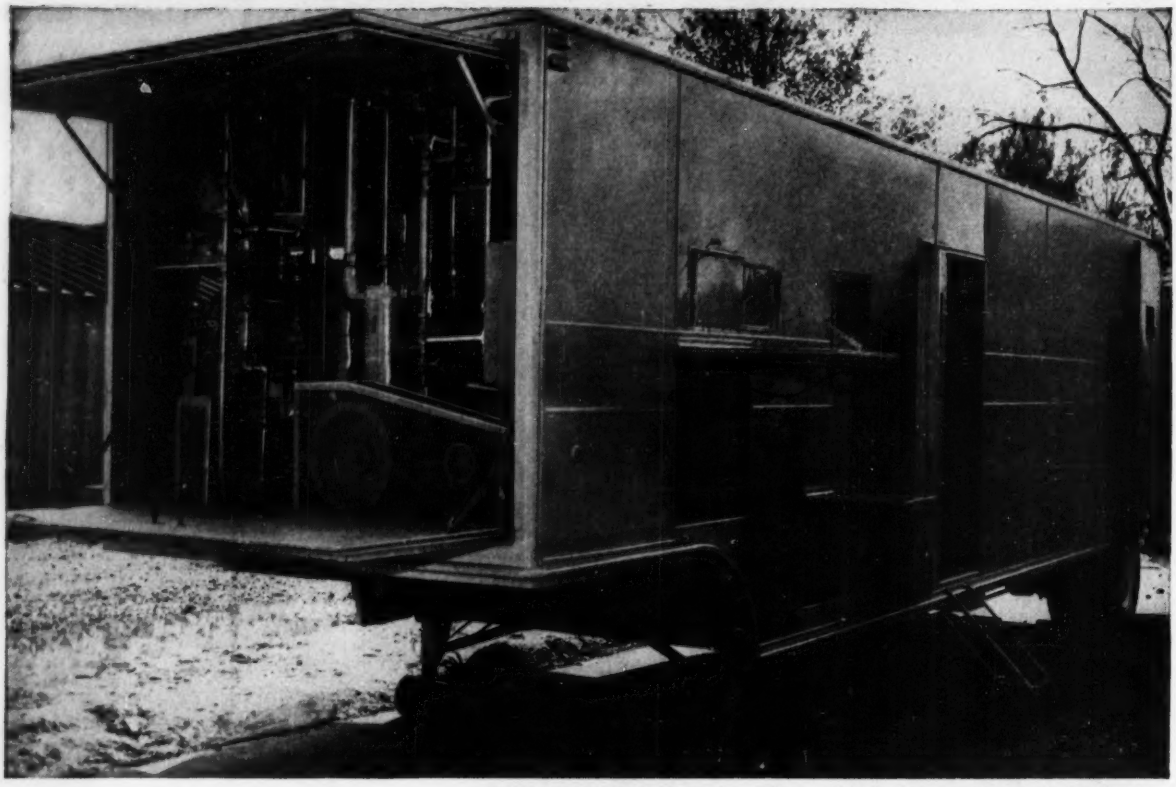
WRITE FOR THIS FREE BOOKLET

How to reduce maintenance costs through better coating practices

This valuable guide can help you effect substantial savings on maintenance costs. It lists the vital steps which can often mean the difference between long coating life or early failure. The guide discusses correct coating selection methods, and it thoroughly describes surface preparation and application techniques. Included is a suggested test for evaluating chemical resistance properties of coatings, as well as a checklist of safety precautions. For your free copy write:

Amercoat CORPORATION

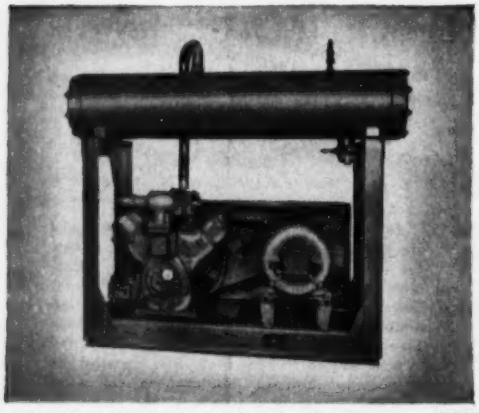
Chicago, Illinois • Kenilworth, New Jersey
Jacksonville, Florida • Houston, Texas
Dept. A, 4809 Firestone Blvd., South Gate, California



CARBON DIOXIDE SUPPLY from this mobile plant finds wide use in fire fighting apparatus of the Armed Forces as well as in numerous industrial applications.

Worthington condensing unit in portable CO_2 plant

Mobile carbon dioxide generator designed for use of Armed Forces



YEAR IN, YEAR OUT — this new Worthington 4JF4 condensing unit delivers peak performance. Its versatility makes it the ideal choice.

At isolated airfields, depots and other military installations, a dependable supply of carbon dioxide for fire fighting apparatus is a must. This new portable carbon dioxide plant produced by the Girdler Co. of Louisville, Kentucky, was designed to meet those needs, and has been accepted by the Armed Forces.

The plant operates through the absorption of carbon dioxide from flue gas by Monoethanolamine — which in turn is regenerated. The carbon dioxide driven off is then cooled, compressed and condensed. And for this vital condensing cycle, a Worthington condensing unit with a 20 hp Freon-12 compressor was specified. The versatility of this rugged and compact unit made it an ideal choice for the job.

For over half a century, Worthington air conditioning and refrigeration equipment has been meeting large and small assignments for the armed forces, business, and industry. Every Worthington unit is not only Worthington-assembled, but more important, Worthington-*made*. You benefit by Worthington's complete unit responsibility:— a good reason to think of Worthington when you think of air conditioning. Get in touch with your nearest Worthington district office, or write Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.35, Harrison, New Jersey.

A.4.35

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

• Davison Bulletin •

CONFIDENTIAL CONFIDE

Confidential handling of catalyst problems is one of the reasons why Davison is the major catalyst producer in the country. Intricate coding plus restricted internal distribution keeps your catalyst secrets safe in Davison hands.

Davison recognizes that catalysts are the heart of chemical reactions, therefore, they are a most carefully guarded secret.

And Davison is equipped to meet the requirements of almost any given catalyst problem.

Bring your catalyst problem to Davison where you are assured of confidential handling. Call your Davison Field Service Engineer or write.

Chemical Progress Week May 17-22

HYDROGEL
to induce microporosity

Manufacturers are using economic hydrogel to induce microporosity in rubber, resins and plastics. Material is a highly hydrated amorphous silica. The hydrogel, which is incorporated in rubber products, shrinks during drying operations thereby inducing porosity.

Davison hydrogel (SiO_2) x H_2O is colorless, translucent and available in semi-solid lumps or finely divided. The range of pH is 3.7 — 4.8.

For further information, samples, priced — call your Davison Field Service Engineer or write.

SOME STANDARD CATALYSTS AVAILABLE

V_2O_5 · K_2SO_4 on Silica

SiO_2 · Al_2O_3 Combination

Pt · SiO_2 Combination

$Hg\,Cl_2$ on Charcoal

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

Baltimore 2, Maryland

Producers of: Catalysts, Inorganic Acids, Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO Granulated Fertilizers.

Please send me information on

☐ Product Data Sheet — Davison Hydrogel

☐ Specialty Catalysts

Name .....Title.....

Company .....

Street .....

City .....Zone....State.....

REM-CRU TITANIUM

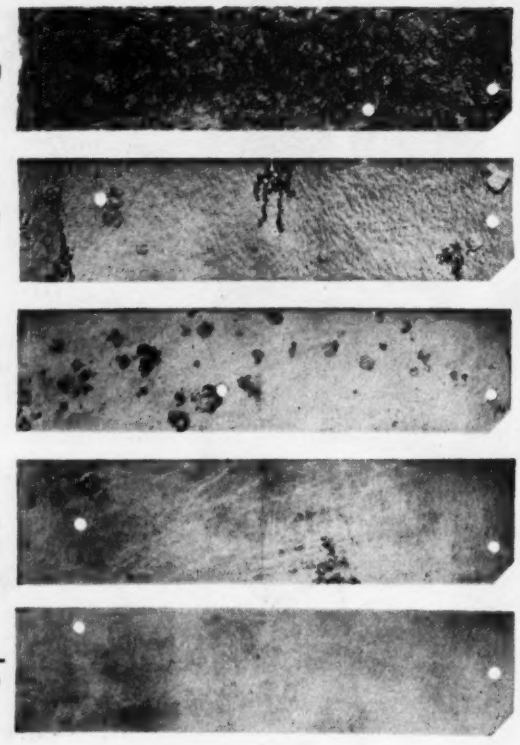
Corrosion Rate in Salt Water— .001" in 1250 Years

Specimens of four popular structural metals and Rem-Cru RC-70 commercially pure titanium, illustrated, were immersed in sea water for almost five years at International Nickel Company's corrosion test site at Kure Beach, North Carolina.

Examination of test results shows clearly that the RC-70 titanium specimen is the only one completely free from pitting. It would have taken 1250 years to reduce the thickness of the titanium sample .001", under these test conditions. And Rem-Cru titanium has proved itself exceptionally resistant to many other forms of corrosion. It is not attacked, for example, by such corrosive environments as nitric acid, strong alkalis, sulphur or sulphur compounds, chlorinated solvents, chlorides, such as cupric and ferric—in fact nearly all salt solutions. Even the mineral acids do not attack titanium under oxidizing conditions. It is ideal, for example, for anodizing racks.

Chemical engineers are discovering dozens of new applications where Rem-Cru titanium does a job no other structural metal can do as well.

Now, Rem-Cru's production facilities have been greatly expanded and titanium sheet, strip, plate, bars, billets, wire and tubing are available for prompt shipment. Many commercial applications are being developed to take advantage of the corrosion resistance of this unique metal.



Corrosion Test Results

MATERIAL	1	2	3	4	RC 70 COMMERCIALLY PURE TITANIUM
Corrosion rate-mpy (thousandths of an inch per year)	0.857	0.164	0.117	0.063	0.0008
Maximum depth of pitting	Perforated	Perforated	.060"	.050"	none
Specimen thickness inches	.037"	.035"	.068"	.070"	.047"

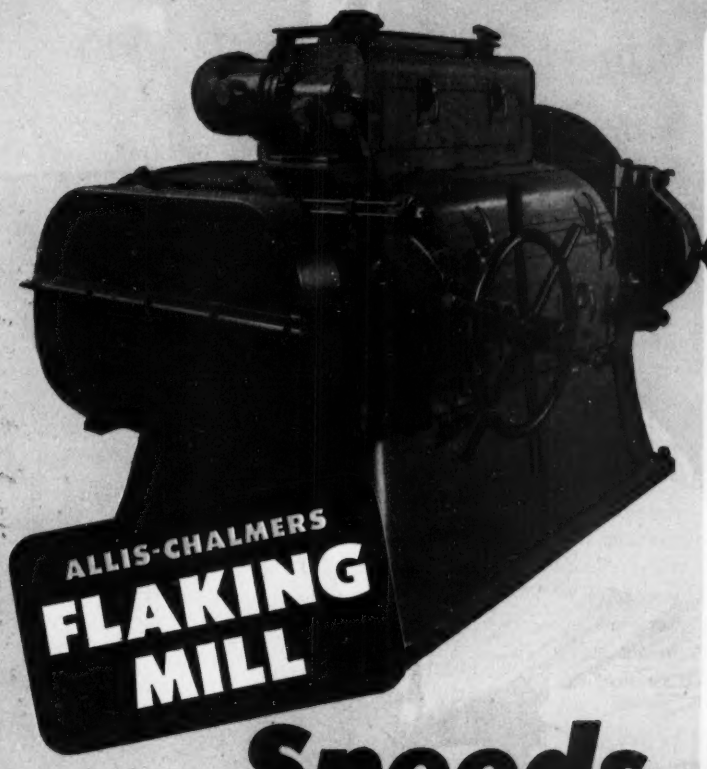
Complete test data furnished upon request.

To keep abreast of the latest developments on this vital metal, write for the Rem-Cru Review—a free periodical devoted to the application and fabrication of titanium and its alloys.

REM-CRU TITANIUM

REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA

ALLIS-CHALMERS Reduction and Separation Equipment



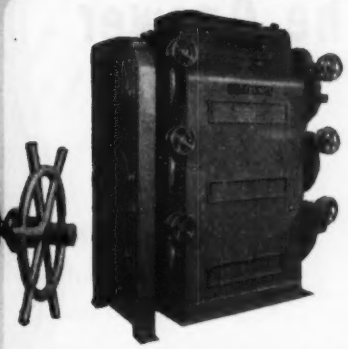
Speeds Subsequent Grinding Two to Four Times

Looking for a way to speed your product reduction? If you are not *pre-mill flaking*, your procedure is not as efficient . . . not as fast as it could be.

By compacting mill feed into broad surfaced flakes, the Allis-Chalmers flaking mill makes the job of your impact mill much easier. The principle is basic . . . flakes shatter more readily than other forms of material. In actual plant operation, doubled, tripled, even quadrupled impact mill capacities have been credited to pre-mill flaking with the Allis-Chalmers flaking mill.

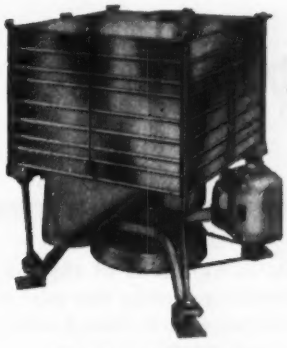
Pre-mill flaking is representative of the adaptation of Allis-Chalmers integrated equipment and engineering . . . adaptations that pay off in high production, top quality products and low processing costs. For further information, contact your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4216

Circle is an Allis-Chalmers trademark.



Style N ROLLER MILLS

In the Allis-Chalmers three stage roller mill there is no excessive shattering . . . no size-destroying impact. Each progressively finer grinding is extremely gentle. Fines are kept at a minimum. Yield is greatly increased. To meet varying requirements, Style N roller mills are also available in one pair and two pair high types.



Circle SIFTER

Stacked decks save space! The *Circle* sifter, utilizing gyratory motion, provides the screen area of a single deck-type screen requiring *four times* the floor space. Flexible capacity, quick product changeover and positive method of tensioning screen are other advantages of the stacked deck design.

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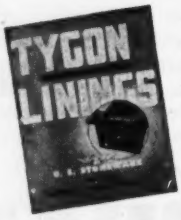
PROVEN in hundreds of the toughest possible applications during the past fourteen years, flexible Tygon plastic linings offer more value today than ever before.

Greater toughness — more stability — even longer life. These improved performance characteristics stem from improved manufacturing techniques, resulting in a denser, more homogeneous body. Top quality yesterday, Tygon is an even better material today.

And along with improved quality — application methods have been simplified. Application is no longer a "factory" must. Strategically located Tygon licensed applicators can now install Tygon linings quickly and economically. Coupled with lower applied costs are important savings in freight costs — and vitally important savings in time.

For that next "tough" tank lining problem — ask for, insist on — Tygon.



This new booklet tells the "down-to-earth" facts about Tygon. Where and how to use it. When not to use it. A valuable reference for every engineer faced with corrosion problems. Free on request. Write for your copy today!

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U. S. STONEWARE

AKRON, OHIO

MAY 1954

Chementator

Edward T. Thompson

• Heyden Chemical will expand trimethylol ethane (TME) capacity. Reasons: field testing of the new glycerine substitute has gone over big and the firm has an extra $11 million to spend from the sale of its antibiotics division to American Cyanamid.

• May 1 is the completion date for Newport Industries' $2.7 million tall oil refining and processing plant at Bay Minette, Ala.

First non-government butyl project

A new butyl rubber plant to be built with private capital is under serious consideration by Cities Service and Continental Oil. If plans go through, it will be the first non-government-financed butyl operation in the U.S.

So far, the two oil firms have formed a new company—Petroleum Chemicals, Inc.—and signed a license with Standard Oil Development Co. that gives access to technical know-how needed for a complete economic evaluation. The new company also expects to make a serious bid for the government-owned GR-S plant at Lake Charles, La., now operated by Firestone Tire & Rubber Co.

Texas ammonia plants seek backers

Despite rumors to the contrary, Chillicothe Chemical Mfg. Co.'s planned urea-anhydrous ammonia plant at Chillicothe, Tex., is still very much alive. According to company organizer Henry Brandon, the firm has definitely severed connections with Foster Wheeler—which originally evaluated the project—is now negotiating with other prime contractors.

Initial plans called for a $16-17 million plant to make 180 tons of anhydrous ammonia and 160 tons of urea fertilizer per day from natural gas. Product goals remain unchanged, but the actual cost may be considerable lower.

Due to a difference of opinion among the firm's original backers, financing plans are still uncertain. Nevertheless, Brandon is confident that construction will start this year.

A second big Texas ammonia-urea venture that's in the news is United Chemical Co.'s Timpson, Tex., plant. It will produce anhydrous ammonia, converting the entire volume to 320 tons per day of urea (44 percent nitrogen). Grover Hartt, Sr., president of United has little to say about financial backing for the $18-million plant, except that insurance companies are expected to put up most of the capital.

But events seem to be moving more smoothly for United than for Chillicothe Chemical. Foster Wheeler is to be the principal contractor and ground will probably be broken by July or August. Both the 166-acre plant site and a dam for a 3 million gal. per day water supply are expected to be donated by the citizens of Timpson, although Hartt says his firm is not dependent on this gift.

New synthetic rubber plant for ICI

England's first big-scale, specialty synthetic rubber products plant is going to be built by Imperial Chemicals Industries, Ltd. Pilot plant production is slated for this year, full scale capacity of 11,000 short tons a year in 1955.

High on the list of products to be made are rubberlike polymers for shoe soles, oil resistant substances and hard reinforcing resins for emulsion paints.

Like most chemical companies, ICI starts planning huge new expenditures even before current spending programs are well underway. The company has already spent $588 million, is in the process of laying out another $168 million and is expected

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to approve still another $196 million very shortly.

There have been no hints yet as to where the new money will go. Even the current $168 million program has not been completely routed, but this much is known about it. Nearly $17 million will go into doubling the capacity of ICI's cracking plants at Wilton, England. Some money will be used to expand production of butadiene, soda ash, caustic soda and chlorine. A new $10 million plant will be built to turn out 1,650 tons a year of titanium metal. And there will be substantial expansion of nylon and Terylene (Dacron) capacity.

Terylene expansion now planned will permit ICI output to be raised again to its traditional relationship with Du Pont's Dacron. ICI usually makes just about one-third the volume Du Pont does, but has recently dropped somewhat below that level.

Swedes to make sulfite pulp from pine

By next fall you may well be hearing a lot about a new commercial Swedish method of making sulfite pulp from pine instead of fir. It is believed to be based on the removal of resins in the pine. Similar attempts in the U. S., using an ammonia-based sulfite liquor, are still very much in the experimental stage.

Developed by Stora Kopparbergs Bergslags AB in Skutskaer, Sweden, the process is said to give a pulp that's as strong and white as that taken from fir by conventional sulfite pulping. Steps have already been taken to convert the company's entire production from fir to pine for large-scale commercial tests.

If successful, the new method should greatly strengthen Sweden's position in the world paper market because of her large pine forests. U. S. interest will probably center around the tracts of Norway pine in Maine and New York. There are also large pine forests in the South, most of which are now used to make kraft pulp.

Wax from fir bark gains speed

Pilot plant removal of high-quality wax, tanning agents and other products from Douglas fir bark is about ready to start. M. W. Kellogg Co., which recently obtained an option on the Oregon Forest Products Laboratory process for this, has arranged with the Soya Co., Wilson, Ark., to do the semi-commercial extraction work.

Kellogg began market studies on the wax in 1952, now plans extensive production for wide-scale customer evaluation. Eugene, Coos Bay and Roseburg, Ore., are already being considered as possible sites for a commercial plant should the process prove successful.

Zone-melting yields ultrapure germanium

Bell Telephone Laboratories have developed an amazingly simple refining process for purifying metals, organic and inorganic substances. First commercial use is in making near-perfect germanium that has one part of impurity in 10 billion parts of the metal.

Called zone-melting, the process is currently being used to refine all of Bell's single-crystal germanium for use in transistors. In addition, extremely pure tin and antimony have been made on an experimental scale and inventor William Pfann of Bell expects that the technique will find use in refining such chemical products as waxes and sodium chloride. Actually, says Pfann, any material now being purified by fractional crystallization can be refined by the new process.

Zone-melting is based on the fact that impurities are usually more soluble in the liquid state of a substance than in the solid. Thus a narrow molten zone moved slowly along an ingot of relatively impure materials sweeps the impurities to one end of the bar.

In the commercial installation, germanium passes through a series of circular induction heaters that melt it at about 1,760 deg. F. Each molten zone extracts its share of the impurities left from the preceding zone. The end section of the ingot, loaded with impurities, is then cut off.

Catalyst for plastics ruled explosive

At least two Connecticut plastics manufacturers have been forced to shut down operations because the polymerization catalyst they use—isopropyl percarbonate (IPP)—has been classified as an explosive by the Greenwich (Conn.) Town Court. Considerable significance is being attached to the court's basis for defining an explosive chemical product.

IPP, which is used in the manufacture of CR-39 plastics—diethylene glycol-bis-di (allyl carbonate)—was previously classed as a "flammable solid." This is also the classification for several other plastics catalysts, including the widely-used benzoyl peroxide.

But early this year suit was brought against the Cast Optics Co., Riverside, Conn., for handling and storing an explosive—IPP—without legal permission. The grounds were that the chemical,

(Continued on page 112)

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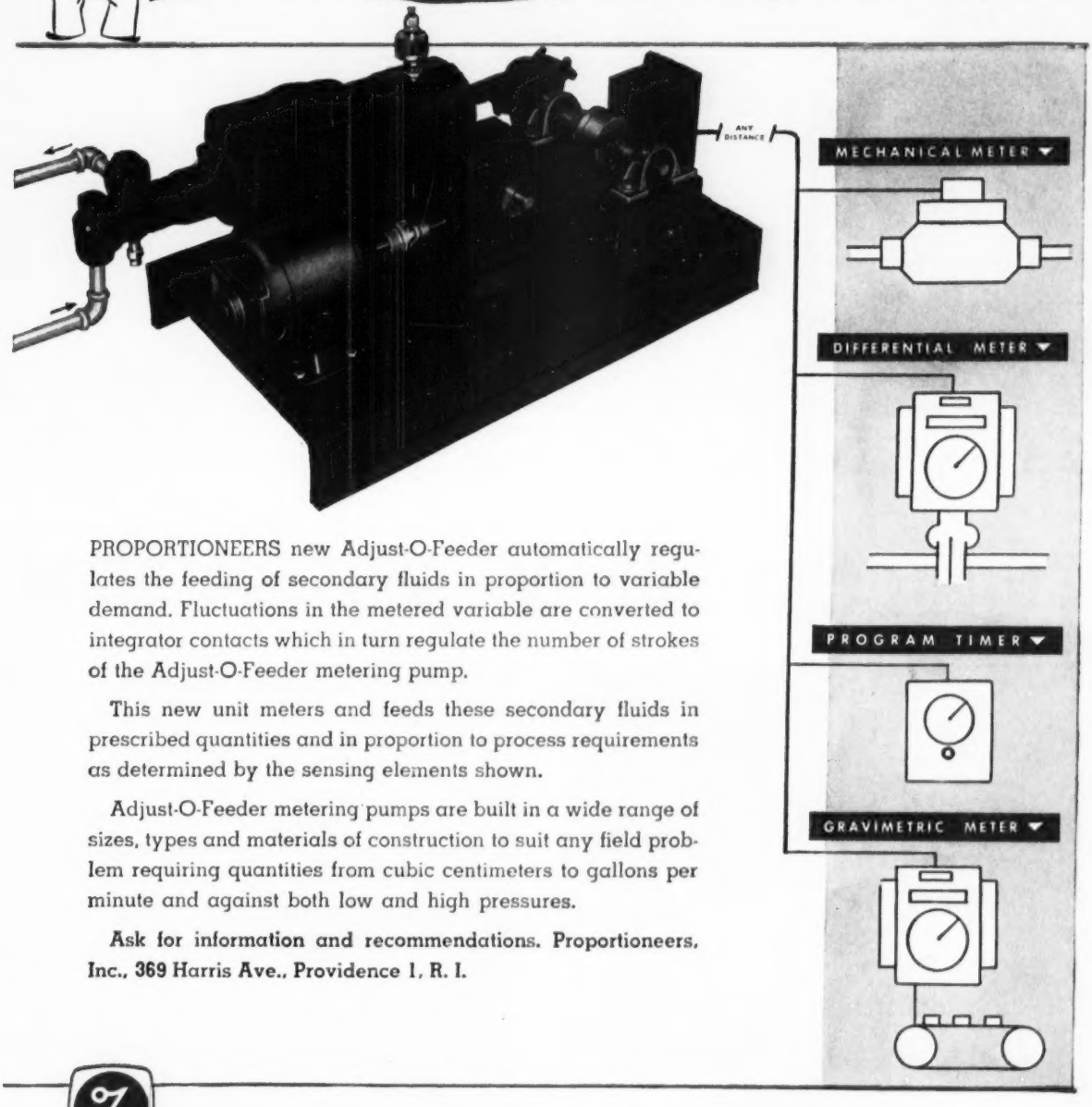
Reagents • Detergents • Inhibitors • Additives

...*directly* without specialized controls



PROPORTIONEERS new Adjust-O-Feeder automatically regulates the feeding of secondary fluids in proportion to variable demand. Fluctuations in the metered variable are converted to integrator contacts which in turn regulate the number of strokes of the Adjust-O-Feeder metering pump.

This new unit meters and feeds these secondary fluids in prescribed quantities and in proportion to process requirements as determined by the sensing elements shown.

Adjust-O-Feeder metering pumps are built in a wide range of sizes, types and materials of construction to suit any field problem requiring quantities from cubic centimeters to gallons per minute and against both low and high pressures.

Ask for information and recommendations. Proportioneers, Inc., 369 Harris Ave., Providence 1, R. I.

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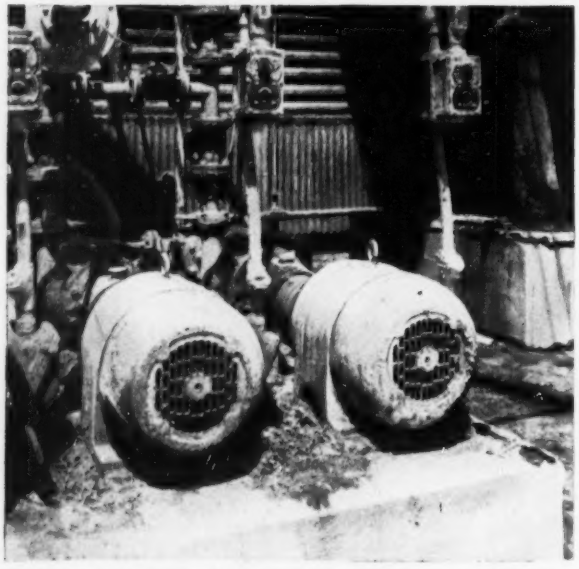
ADVICE: Replace switches and fuses with compact G-E switchgear designed with adequate interrupting capacity. Place the equipment in ventilated room to combat corrosion.

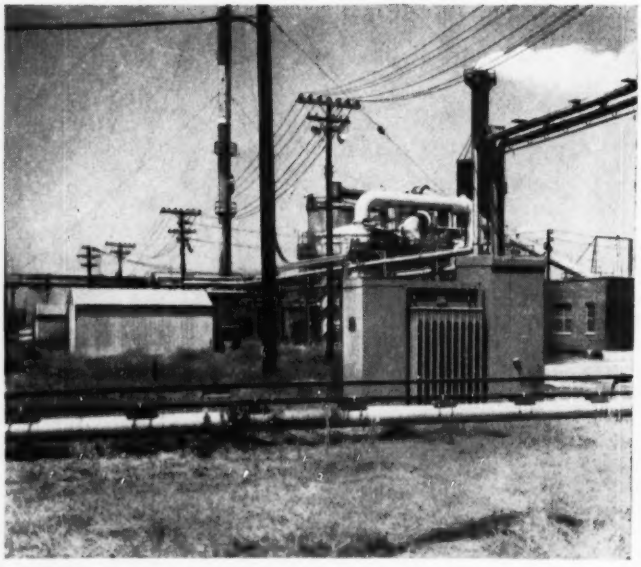
RESULT: Reliable primary power service from main substation. Corrosion problems minimized. Pre-assembly of this metal-clad switchgear at factory cut installation time.

G.E. helps convert wartime plant

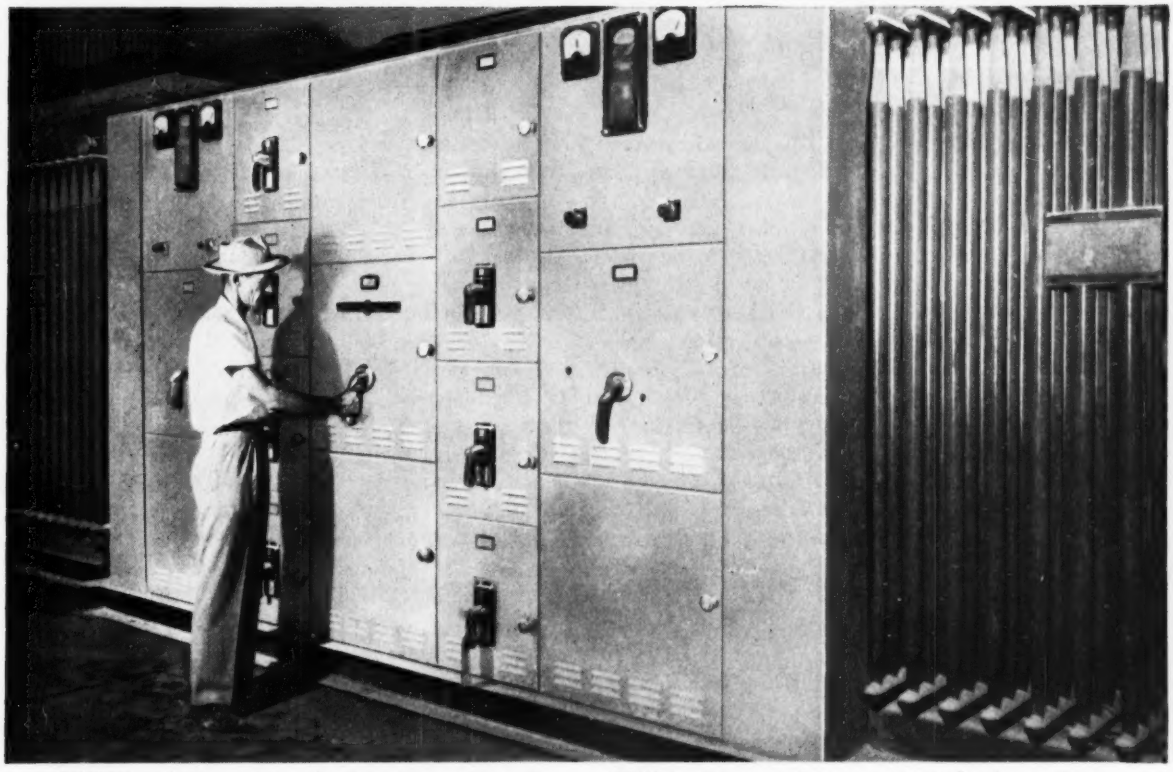


ADVICE: Replace open motors in corrosive areas with G-E totally enclosed, fan-cooled, corrosive resistant Tri-Clad* motors. **RESULT:** G-E motors, such as these driving recirculating pumps, last longer, require less maintenance.

Reg. Trade-mark of General Electric Company.



ADVICE: Place this 500-kva load-center substation near work load which is remote and in less corrosive atmosphere. **RESULT:** Reliable power supply, fewer power lines from primary station, selective fault isolation of secondary circuits.



ADVICE: Replace open pole lines for primary distribution with armored cable. Install G-E double-ended load-center unit substation in ventilated room in center of load area.

RESULT: Fewer and better protected primary lines. Selective tripping of load-center circuit breakers limits secondary power outages to faulty lines. Additional units may be added in the future.

into efficient fertilizer producer

Step-by-step installation of G-E electrical system keeps production smooth at ex-superphosphate plant

A large chemical company operates a superphosphate plant built during World War II, which has been converted to the manufacture of a high-grade fertilizer. The plant's electrical equipment needed to be replaced—and without interrupting production.

General Electric engineers called in on the problem—made an extensive plant survey and recommended a step-by-step electrical modernization program. The program as adopted combined latest techniques and modern equipment to effectively combat the extreme corrosion caused by sulphuric acid, phosphoric dust, and other chemicals.

In succession, a compact G-E primary substation was installed in a ventilated room—vulnerable power lines were replaced with G-E armored cable—G-E unit substations were located near load centers to cut power losses—and open motors were replaced by G-E totally enclosed motors designed for chemical service. Result: the company reports complete satisfaction with the system.

Whether you plan to build, expand, or modernize a chemical plant, you too can profit by the services of G-E specialists in application and field engineering. These and other specialized engineering services are available to you through your local G-E Apparatus Sales representative. Call him early in your planning stage. General Electric Company, Schenectady 5, N. Y.

662-46

Engineered Electrical Systems for the Chemical Industry

GENERAL ELECTRIC

when heated above 50 deg. F. in a sealed container, has a high rate of gasification, liberates its own oxygen and will rupture the vessel.

The defense tried to establish that IPP is relatively inactive in the solid state and that adequate refrigeration facilities and other safety precautions were always present. The court took the stand that there is always a possibility of a breakdown of these facilities and that therefore IPP must be classed as an explosive.

W. E. Chapman, president of Cast Optics, insists that this type of ruling could apply to literally hundreds of chemicals. Safe handling procedures are required in nearly every chemical process. And although not involved in the suit, Columbia-Southern Corp., sole maker of IPP, echoes these sentiments, adds that it has been handling the chemical for over 10 years with no serious mishaps.

The court decision has been appealed to the Court of Common Pleas in Bridgeport, Conn. A ruling is expected early in May.

In the meantime, Cast Optics has stopped using IPP and another user, Optical Plastics Co., Stamford, Conn., has shut down its entire plant. An interim decision from the local fire marshal was that the companies could continue operations only if they installed powder magazines.

ODM offers fast tax write-offs for labs

Chemical, electronic and aircraft firms will probably be the first beneficiaries of a new Office of Defense Mobilization ruling authorizing accelerated tax amortizations for certain new classes of research and development laboratories. Heretofore, only laboratories having defense research contracts with the government were eligible for such tax relief.

ODM has opened up two new categories: laboratories established in connection with an industry product or service which has a separate expansion goal and research facilities for development projects that are clearly demonstrated to be in the interests of the national defense program. As before, control labs for day-to-day plant operation are not included.

Five plants in eight weeks

Pridefully, Singmaster & Breyer, New York engineering firm, has just seen five plants it designed come on stream in less than two months. Spreading themselves over three continents, S&B also managed or supervised the construction of all five.

Built in this country were a phosphoric acid plant for Smith-Douglass Co., Streator, Ill., Stauffer Chemical's carbon tetrachloride plant at Louisville, Ky., and zinc roasting and acid facilities for Sullivan Mining Co., Kellogg, Idaho. Overseas operations are a vertical zinc retort, Mitsui Mining & Smelting Co., Ltd., Omuta City, Japan, and an ammonium nitrate installation for The Fertilizer Plant, Inc., Reykjavik, Iceland.

Considerable interest has been shown around industry in both the phosphoric acid and ammonium nitrate plants. The former is the first in the U. S. to use the Belgian Prayon process.

Guaranteed to give a 95 percent yield—based on P_2O_5 entering—the Prayon process controls the leach system temperature by evaporative cooling. In addition, the entire plant requires only one filter—a new Prayon horizontal type whose revolving trays overturn to dump the filter cake. Just three days were needed to bring the plant up to full capacity production.

Key to the 18,200 metric-ton-per-year ammonium nitrate plant in Iceland is its continuous, two-stage crystallization system that yields true crystals, not granules or dust. And little or no outside heat is required.

Nitric acid and ammonia are introduced into a concentrator-reactor. Heat of reaction is just enough to keep the concentration of the reaction products at the correct level for final crystallization in a second vessel. Control, which was expected to be difficult, has actually had considerable latitude.

One huge oil-chemical union?

On August 23, or thereabouts, a number of independent oil unions are scheduled to merge formally into one big body—the Oil and Chemical Workers International Union.

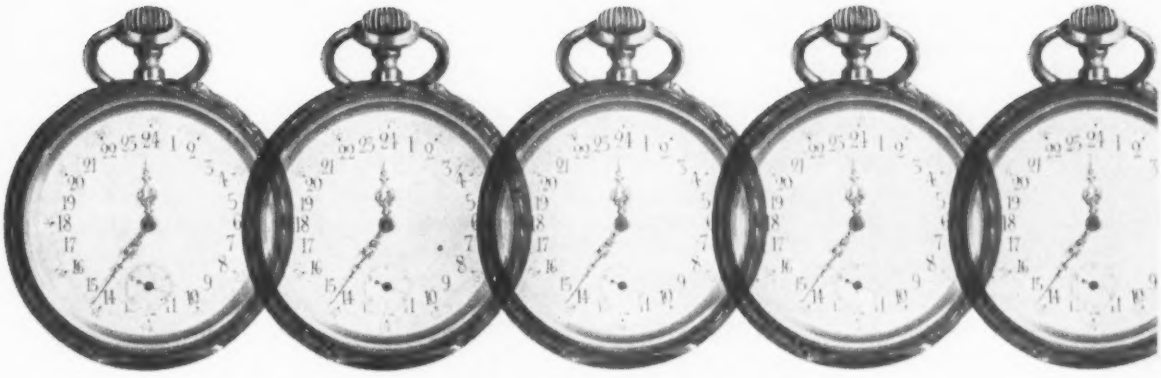
Purpose of the move, says O. A. (Jack) Knight, chairman of the temporary ratifying committee, is "to unify bargaining efforts in the industry and achieve a greater degree of bargaining strength and efficiency not possible with several unconnected unions."

As its name implies, the projected union hopes to expand into the chemical industry, particularly petrochemicals. But for the present, Knight insists, "there is no immediate prospect for other than normal expansion of the union in this field . . . We have always claimed oil and related industries . . . We do not plan any open break with the United Gas, Coke & Chemical Workers (CIO)."

Just how many of the independents will go

(Continued on page 114)

You're Just Hours Away...



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CHEMICAL PROGRESS WEEK • May 17 to 22 • *A Better America Through Chemical Progress*

along with this coalition probably won't be known until mid-June or later. But there were indications of strong support in Philadelphia recently when 31 oil unions, representing 212,440 oil workers, met to draft a constitution. Biggest booster was the Oil Workers International Union (CIO), headed by Knight, which claims to represent 130,000.

Confidently estimating a potential membership of over a million, delegates to the Philadelphia meeting intimated that industry-wide wage patterns, such as are used in the steel and coal industries, is the ultimate aim of the merger. And subsequent statements by the temporary committee and by Knight, although purporting to disclaim this, have done little to allay oil and chemical company worries over such a development.

Said the committee, "we seek precisely the same degree of industry-wide, company-wide and inter-company cooperation on the part of employees as is now exercised by management." To this, Knight, in an exclusive interview, added, "we bargain with a highly coordinated, interlocking industry. Therefore we need a high degree of coordination between wage earners from coast to coast in order to bargain on anything like an equal basis."

For oil executives, these words indicate not only desire for industry-wide bargaining, but for a national wage scale, as well. And they mean to fight both dangers right down the line.

When questioned on standardized wages, Knight had this to say: "I believe that a basic principle of almost any labor union is that there should be equal pay for equal work regardless of where or by whom work is performed. . . While I expect we will always attempt to equalize wages for equal work, I do not believe we want a pat national formula on wages."

This points up another basic industry-union disagreement on an all-encompassing union. What are the advantages—or disadvantages—for workers in the oil and chemical industries?

The committee feels that the greater bargaining power it will have is bound to make the workers a "more evenly matched force to meet the highly coordinated industry with which we bargain." The companies counter that many local unions enjoy better than average working conditions and wages only because they have not been forced to accept "equal pay for equal work," without regard for local living and operating costs.

Saccharin via new process

Starting with phthalic anhydride and ammonia, Maumee Chemical Co., Toledo, Ohio, is now on stream with a successful new commercial way to make saccharin. Most significant feature is that profitable operations do not depend on the sale of byproducts.

In the conventional method used by Monsanto, a number of byproducts are produced that must be sold. And outlets are not always easy to find. Maumee, on the other hand, makes only intermediates in its nine-step process. All can be converted to saccharin if desired.

Currently aiming for about one-third of today's one million pound saccharin market, the company has found an important industrial application for the product in the nickel electroplating field. Use of saccharin here is said to give better surfaces using less nickel. One company is already using the technique commercially.

And volume applications of some of the intermediates produced are expected. Most important of these products are phthalimide, anthranilic acid, dithiobenzoic acid and its dimethyl ester.

Oil companies spend fortunes, plan more

Expansion plans for the petroleum industry, always breath-taking, assume even greater significance this year in the face of reduced spending through most of the rest of the economy. Not one of the six leading oil companies expects lower capital expenditures this year than in 1953. Most plan considerable hikes.

First to announce its plans was Standard Oil Co. (Ind.). The company's spending totaled $209 million last year, will average $250 million for 1954-55. About half of this will go into development of new crude oil production and reserves, but refining will get its share, too. Included are a 30,000 barrel per day fluid hydroformer at Whiting, Ind., plus four Ultraforming units: Texas City—21,200 bpd.; El Dorado, Ark.—6,800 bpd.; Wood River, Ill.—9,000 bpd.; Casper, Wyo.—3,750 bpd.

But although this is a staggering sum, it's dwarfed by the report from Standard Oil Co. (N. J.). Esso and its consolidated affiliates spent nearly $509 million in 1953, plans an increase this year.

And the same story holds true right down the list. Shell Oil plunked down $238 million last year, sees continued high spending for at least two more years. Gulf estimates $250 million for 1954, as compared to $221 million last year. The Texas Co. expects to raise this year's outlay above its $230 million of 1953. Socony-Vacuum, although it deferred some projects from 1953 to 1954, still racked up an impressive $225 million last year.

What's Happening . . . page 116

Multi-plant facilities multiply your safety

From Quebec to the Gulf, Mathieson shipping points form a chlorine supply line serving the major industrial areas of the East, South, and Midwest. At Mathieson, your chlorine source is backed up one or more times to assure dependable supply and reliable delivery schedules.

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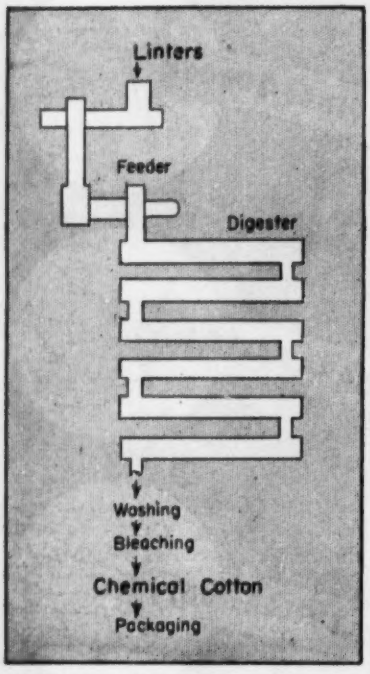
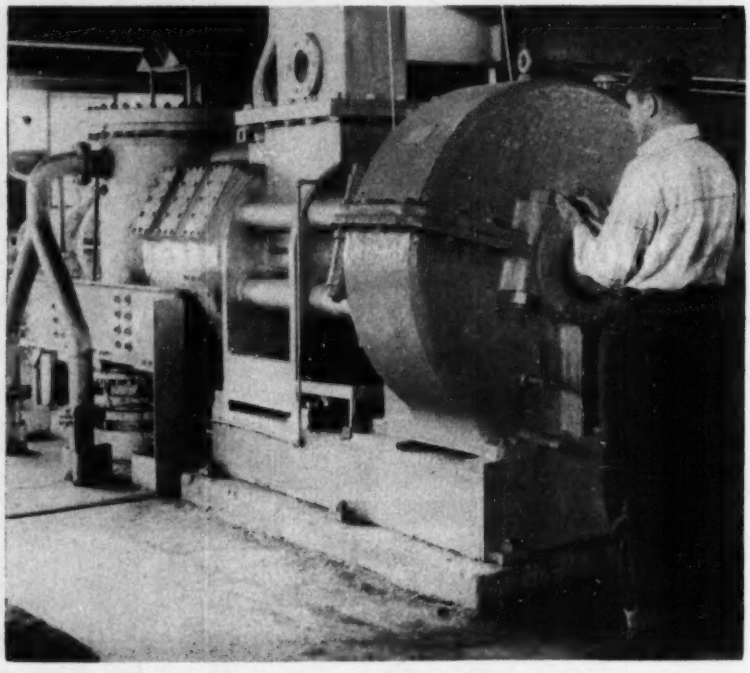
MAY 1954

What's Happening



DIGESTIVE SYSTEM



FEEDER for fibrous linters holds a steady flow and seals against 150 psi.

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How Continuous Digester Holds

At Hercules they're making fibrous solids flow continuously

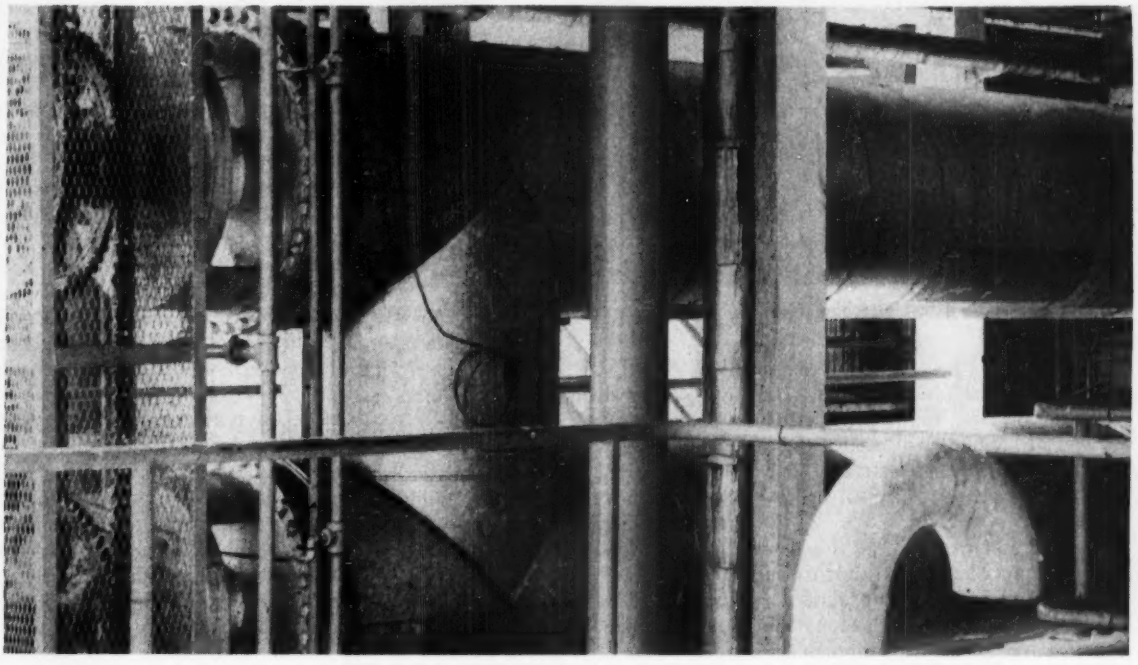
Now it's official—Hercules Powder Co.'s continuous process for producing chemical-grade cotton from linters.

On March 30 U. S. Patent 2,673,-690 was issued to mark the unveiling. At the same time Hercules revealed the process has been operating since May 1949 and now is producing at a 300-ton-per-day clip.

▶**Key Unit**—What's unique about Hercules' process is that digestion is carried out on moist cotton fibers rather than fibers slurried in liquor. Fibrous solids are fed through a pressurized digester continuously using an unusual feeder design, as shown. A compressed plug of moving solids seals pressure inside digester.

By licking the continuous digestion problem Hercules has been able to design a streamlined process from beginning to end. Result—a uniformly better product than possible by batch process in somewhat higher yields.

in Chemical Engineering



CONTINUOUS DIGESTER keeps cooking time short with higher pressures, less liquor and no stoppages.

Pressure to Make Better Chemical Cellulose

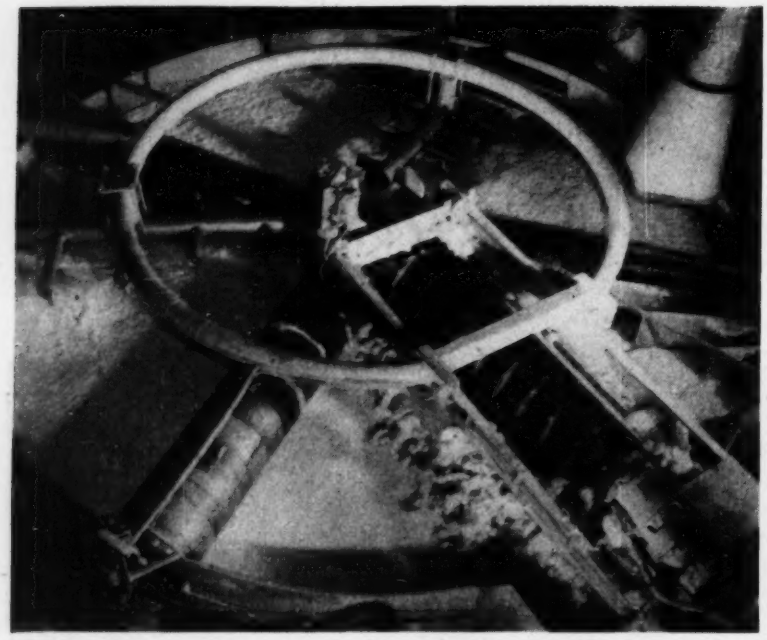
through a pressurized digester. A compressed plug of moving solids seals inlet and outlet.

▶ **Savings**—Operating cost is definitely lower; less cooking chemicals, steam, labor and maintenance are needed than for batch operation.

Then there is a large saving in space. At the Hopewell, Va., plant both the old batch plant and the new continuous process are keyed to a 300-ton-per-day output. A batch in-process time of 18 hr. means a big inventory, much equipment and housing space. By contrast the 1½-hr. in-process time of the continuous process is reflected in small inventory, compact equipment and minimum housing space.

And the new process holds promise of relief for another problem—stream pollution. Waste black liquor is heavy, has a high dissolved solids content. Thus it may now be economically feasible to concentrate the liquor for burning or recovery.

▶ **It's Flexible**—While the new process is fully continuous it maintains the flexibility of the older batch system. Chemical cellulose must be produced in a variety of grades for manufacture of viscose, cuprammonium rayon, cellulose acetate and nitrate, CMC, and ethyl cellulose; also as a fiber used in fine papers, plastic impregnation papers and filter paper. Operating conditions of the continuous system are varied readily to produce these different grades of cellulose.



WASHER following first bleaching is 15-ft. horizontal type suited to fiber washing.

Digester variables are changed several times a day to make different grades of cellulose. Despite these change-overs actual on-stream time runs 95 percent of total plant operating time.

Looking more closely at the new digestion procedure it's possible to see why there are such clear-cut gains.

▶ **Liquor Hitchhikes**—With the linters handled as a fibrous mass through the digestion step they act as a matrix to transport the cooking liquor. Liquor serves one function only—introduction of digestion chemicals to the individual fibers. There is no need for a large bulk of liquor such as required in the batch process.

Liquor can be strong, which means reduced cooking time. And since there's less of it than in a slurry, steam demand is reduced despite higher pressure. Also dry weight of chemical used is approximately theoretical, a marked saving in consumption.

Continuous flow of material with small in-process inventory means uniformity of product. Digestion is complete without over-cooking.

▶ **Into the Act**—Raw cotton linters are first cleaned to remove fragments of seed hulls, bolls and cotton stalks. Following cleaning the linters are delivered into an automatic continuous weighing station.

From the weighing station a continuous flow of fibers is pneumatically conveyed into the processing building and discharged into a wetting-out cell. Here a screw mechanism works-in cooking liquor containing caustic soda and detergents. Leaving the screw the linters contain several parts by weight of liquor for each part of linters.

Wet linters now drop into the feeder for the digester. A revolving screw forces the linters through a cylindrical foraminous jacket, squeezing out excess liquor. Reduction of liquor content at this point is essential to feed and seal the digester.

▶ **Entering the Gate**—Under the propelling pressure of the screw the squeezed-out linters enter the forming tube leading to the digester. Within this tube the fibrous mass is compressed and moved forward at the same time.

The forming tube outlet is through the side of a vertical section of the digester. Directly across from this outlet, on the opposite side of the vertical section, is mounted an air-loaded piston. The end of this piston forms a seal when it is in contact with the outlet of the forming tube.

Inside the tube the linters are forced ahead by the screw until the force exceeds that of the piston. Then the piston is pushed back by the linters until a substantial portion of the lengthened body of linters breaks into fragments and drops into the digester.

As long as linters keep feeding, a balance point is maintained so there is a continuous flow of linters into the chamber without releasing the pressure. If linters flow drops off or ceases then the piston reseats against the end of the tube to seal off the chamber.

Steam and additional cooking liquor also are injected into this vertical section of the digester. Steam input is balanced to hold the digester at the desired pressure.

▶ **Cook on the Run**—At the bottom of the short vertical section the fibers enter the first of eight horizontal, interconnected chambers. Revolving screws move the material along. Since the chambers are mounted one over the other, transfer to the next in line is by a drop through a short vertical leg.

Cooked linters leave the digester through a foraminous jacket and forming tube similar to that on the feed end. The outlet end of the forming tube is attached to a receiving chamber. Several times a minute a discharge gate on this chamber opens and pressure blows the fibrous mass into the repulp tank.

▶ **Bleach and Wash** – Subsequent bleaching and washing steps are done on slurried fiber. A cold acid-chlorine bleach in an upflow tower is followed by a high density alkaline-hypochlorite bleach in a specially designed downflow tower. Washing between stages is done on horizontal vacuum filters using a countercurrent system.

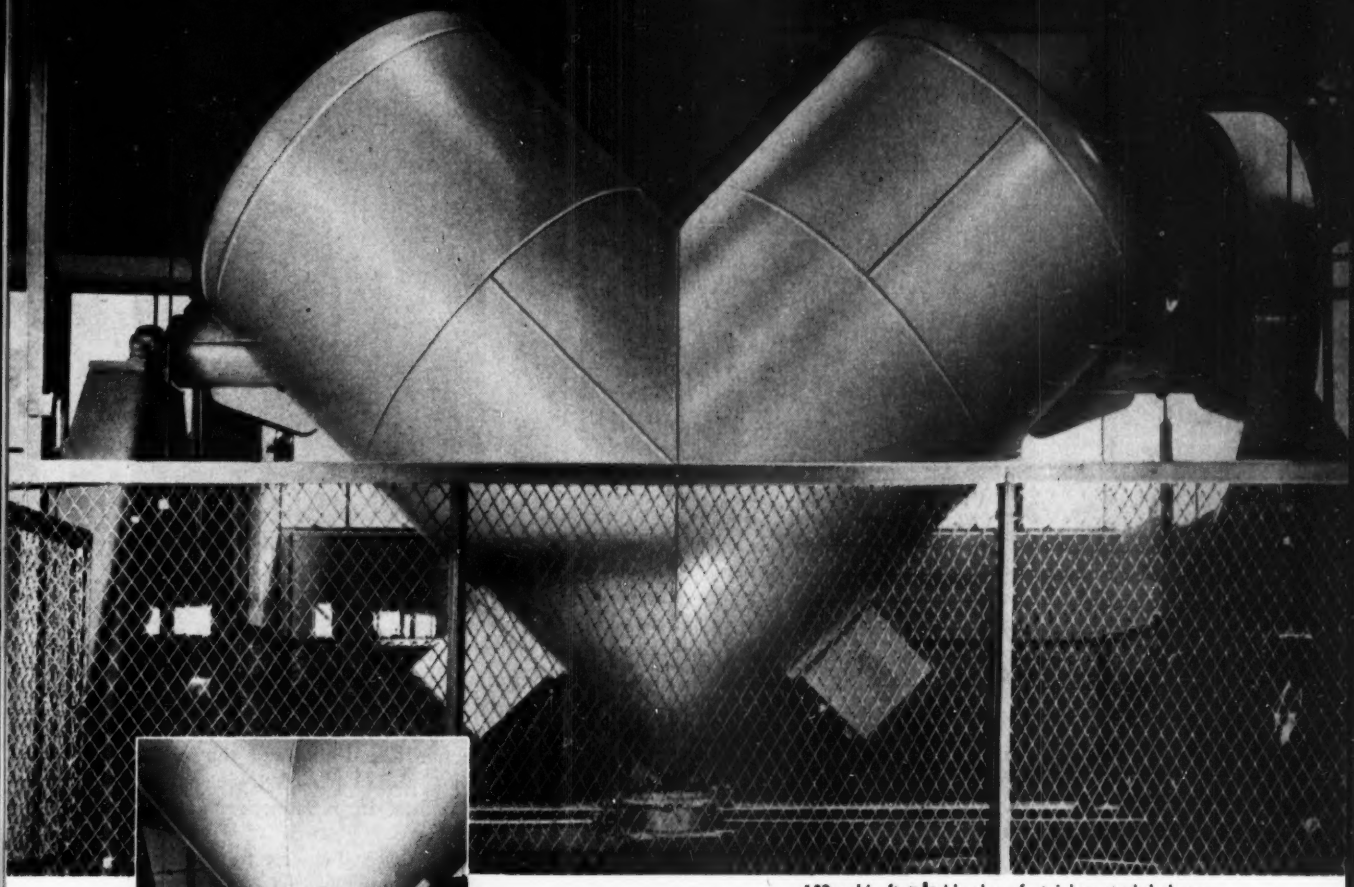
Two interesting points about bleaching—chlorination can be inhibited as desired to help control viscosity of the final product and the high density stage is controlled with aid of strain gages under the tower.

These advantages typify a bleaching process and equipment engineered and built by Hercules. All previously tried processes are limited to usage on wood pulp.

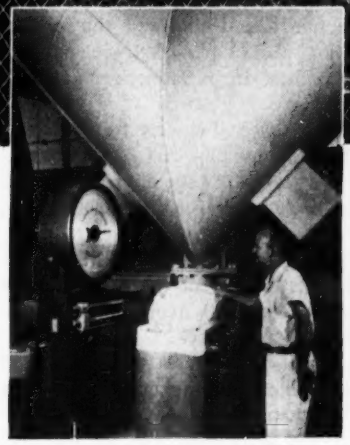
Final product is dried either in sheet form or as a loose mass. Baling and wrapping are performed automatically.

HOFFMANN-LA ROCHE, INC.

blends a 3-ton dose of vitamins



150 cubic ft. p-k blender of stainless steel-clad construction is charged through opening in floor above.



Shown is ease of discharge of p-k blender.

Hoffmann-LaRoche, Inc., Nutley, N. J., leading pharmaceutical manufacturers, find blending a three-ton dose of vitamins in one batch an easy matter with a **p-k** twin shell dry blender.

And, at the same time, the patented **p-k** blender provides perfect dispersion of the ingredients, as uniformly as a druggist compounds a single prescription.

The 150 cubic foot **p-k** blender shown here is at work every day in the modern Hoffmann-LaRoche plant at Nutley, N. J. Five different particle sizes are perfectly blended in 6600-lb. batches in this **p-k** blender. Clinical cleaning is easy, because of the wide openings of the **p-k** blender.

If your blending needs a shot in the arm, write today for complete information on sizes and capacities.

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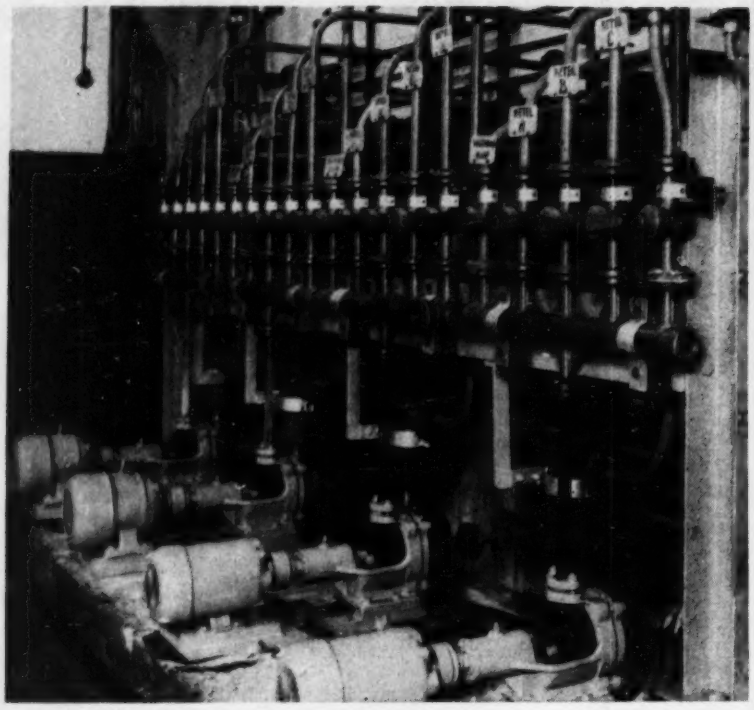
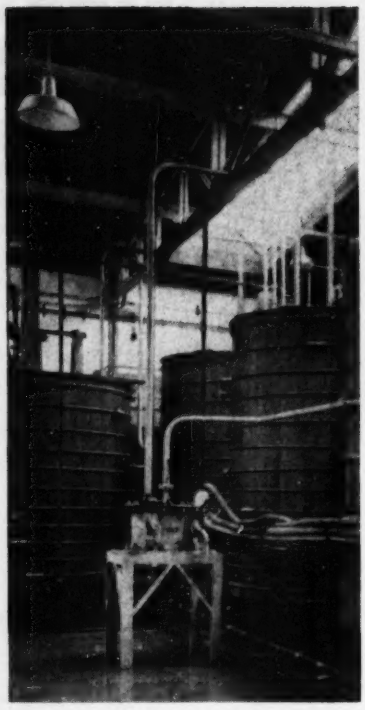


PIPING MANIFOLD distributes materials to . . .



FERMENTATION tanks like these.

Take a Fresh Look at Citric

Profitable citric acid manufacture has been sought by many, has eluded most. Here's a chance for you to throw your hat into the ring—and keep it there.

Details of how to make citric acid by fermentation—one of the world's best kept industrial secrets—are now available to prospective U.S. producers through Scientific Design Co., New York.

This know-how is based on four years' joint development work which resulted in the start-up last summer in Holland of a revised and improved citric acid process. Collaborator in this work and operator of the multi-million-dollar plant shown above is the Dutch pharmaceutical and chemical firm, Noury & Van der Lande, in Deventer.

▶ **New Competition**—So complex is the fermentation process and so low is the selling price—27 to 29 c. per lb.—that few citric producers have been able to survive the pace. Technology has developed to such a degree that the chemical can sell at a price equivalent to that of maleic anhydride, a compound made from benzene in a one-stage catalytic process requiring much less labor and shorter cycle times than those necessary for citric manufacture.

Scientific Design believes that the new Dutch process can compete successfully under American economic conditions. Here are some of the advantages claimed:

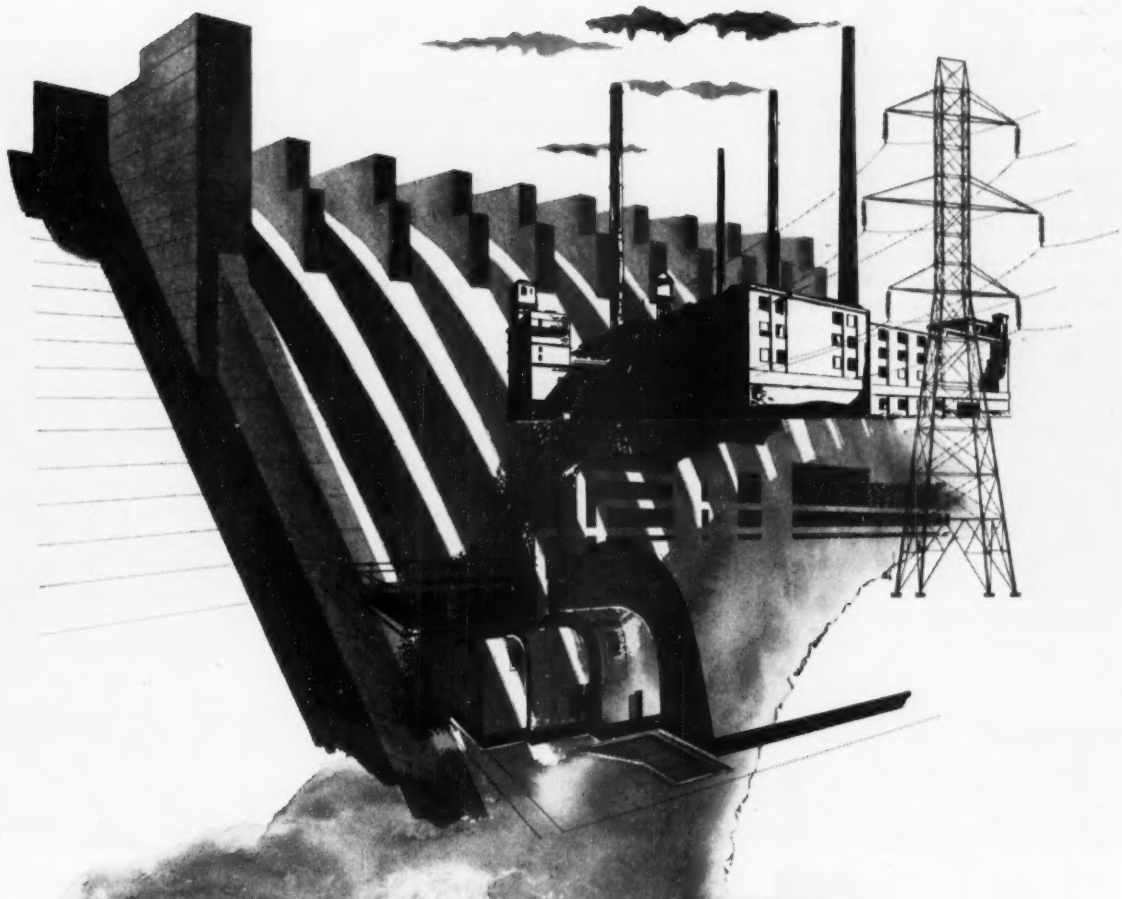
- Wide flexibility in blending of various feed stocks, permitting choice of the optimum and cheapest raw materials.
- An improved fermentation system which obtains high yields.
- A recovery system with high efficiency, capable of producing a wide variety of grades suitable for all domestic and foreign markets.

▶ **Critical Conditions**—Although citric acid is also made commercially by extraction from fruit juices, the fermentation process achieved top position soon after its introduction some 30 years ago.

Raw material is some form of sugar solution, usually beet or cane molasses.* Other essential elements, such as nitrogen, phosphorus, magnesium, iron and manganese, are required. Noury's molasses processing system permits control of the concentration of these critical items despite variations in feed stock.

Molasses lots are pilot-tested first in small-scale fermentations in order to anticipate variations in yield potential and to make possible the blending of various feed stocks to give a carbohydrate source of consistent quality. The nutrient ions are then added to or removed from the feed to obtain the desired concentration level of each one. Often, however, deficiencies or excesses of the nutrients occurring

* Refined sugar solutions have also been employed; there are some indications that such pure feed stocks are required for deep tank fermentation.



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naturally in the feed stocks are compensated for by judicious balancing.

Fermentation yields are also critically affected by temperature, pH, aeration, sterility, materials of construction, character of microorganism and methods of operation. SD and Noury say they have solved these problems to get high yields.

Citric acid is conventionally recovered from fermentation liquors by precipitation as calcium citrate, followed by filtration, acidification, concentration and purification. The latter step itself involves an intricate series of crystallizations and solids handling stages, with separation of byproducts.

Few process details are generally known. Published information, particularly on the fermentation, is meager, with the bulk of data obtainable from patents and not easy to interpret. Reluctance of Noury to share its hard-won knowledge with other than licensees is therefore understandable.

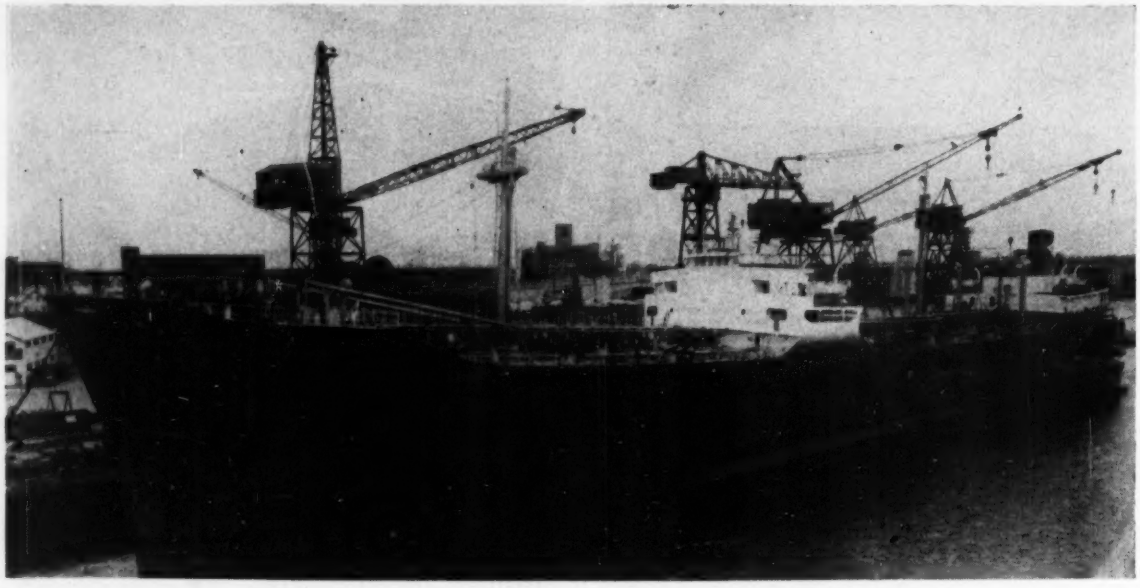
▶ **Citric's Economic Importance**—As the most commonly used organic acid in the food and pharmaceutical industry, by virtue of its tastiness, high tolerance and easy assimilation, citric acid caters to a mighty big market.

An increasingly important industrial commodity, too, citric acid goes into metal pickling, water conditioning, preparation of paints and alkyd resins. Its salts, especially the neutral sodium salt, find many uses in pharmaceutical and food preparations as buffers and stabilizers; its esters are plasticizers for a wide assortment of plastic materials.

Total U. S. output for all purposes is 50-60 million lb. annually.

Foremost producer of citric acid is Chas. Pfizer & Co., successful employer of shallow-pan fermentation for many years. Recently other companies have made moves to get on the bandwagon: Miles Laboratories has installed facilities for deep fermentation at Elkhart, Ind.; Stauffer Chemical has been granted a certificate of necessity for a $2.8-million plant on the West Coast; Kemble Bishop has a new surface-process plant at Cornwall, Ont. In order to protect its leading position Pfizer is itself doing some work on submerged-culture fermentation at Groton, Conn.

And now Noury & Van der Lande, confident of its position in the European market, bids fair to upset the present North American balance by offering its process to interested American firms. The Dutch plant is even being made available for demonstration and operator training purposes under an agreement with Scientific Design.



First Custom-Built Liquid Chemical Tanker

A new ship, the SS Marine Dow-Chem, has just been put into active service between the Dow Chemical Co.'s Freeport, Tex., plant and Gulf and East Coast ports.

Built to carry as many as 11 different liquid chemicals, the vessel has four stern tanks specifically designed to transport 632,000 gallons of 73 percent caustic soda. Total capacity is five million gallons.

Due to the corrosiveness of concentrated caustic, the special tanks, as well as all heating coils, pumps, valves and pipes that will contact the liquid, are made entirely of nickel-clad steel with nickel weldments or of pure nickel. Over 685,000 lb. of nickel-clad and 47,000 tons of pure nickel were used.

The Dow Chem is being leased by Dow from Marine Transport Lines, Inc., New York. It was built by the Bethlehem Steel Co. at Quincy, Mass.

paint-up clean-up center for GATX tank cars

Forty tank cars can be serviced in this paint shop at one time. Every surface—interior and exterior—that can be painted, sprayed or brushed gets its protective covering here. After the car has gone through the mechanical department for necessary maintenance and repair work the important car reporting marks, advertising decoration and other stencilled information are applied. These surface finishes applied at the General American car repair shops increase the usefulness of the 47,000 GATX tank cars and keep cars available for duty.

To keep the fleet rolling, General American's more than 30 car repair shops work with the Engineering and Traffic departments to give shippers more dependable service for transporting liquids in bulk.

Car repair shops throughout the U. S. A.

GATX GENERAL AMERICAN TRADE MARK

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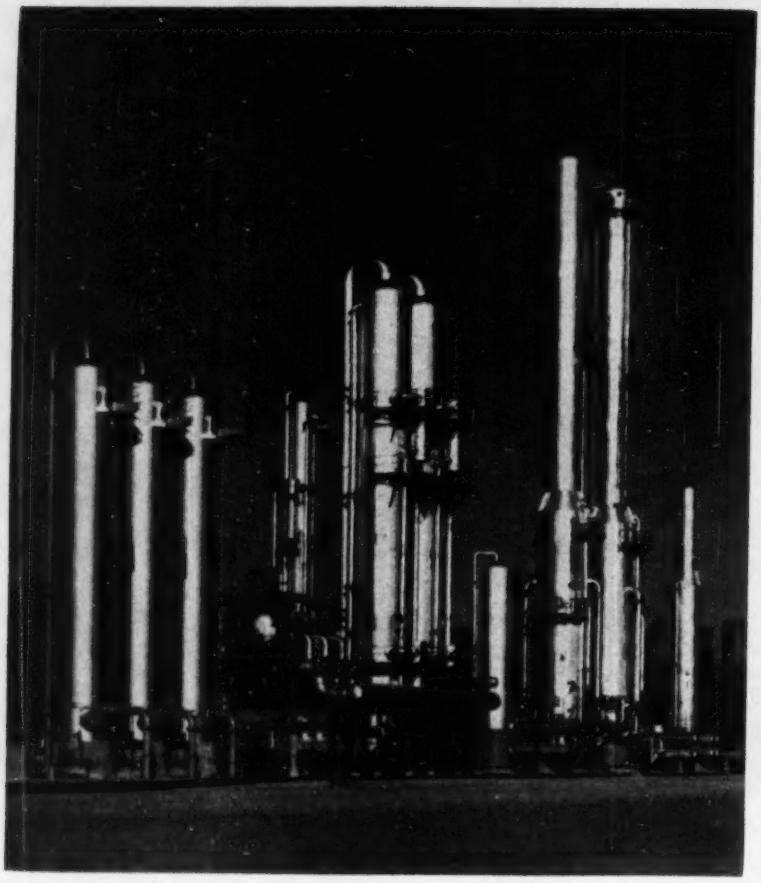


TOWERS at Tuscola range up to 11½ ft. diameter and 144 ft. high.

Kaskades Threaten Bubble-Caps

Chemical plants are turning to Kaskade trays for distillation and absorption towers involving high vapor and liquid loading or low pressure drop.

Springing from a firm foothold in the petroleum refining industry, Koch Engineering Co.'s Kaskade tray is now seeking new victories over the bubble-cap tray in the towers of the chemical industry.

Logical point of attack on the chemical front is the petrochemical flank. The line has already been breached with installations in plants operated by American Cyanamid, Humble, Jefferson, Phillips Chemical, Union Carbide, Monsanto and National Petro-Chemicals.

National Pet's tower installation at Tuscola, Ill., one of the largest to have started up recently, boasts five Kaskade-tray towers. Operating at pressures of 300 to 500 psi., they range in diameter from 8 to 11½ ft. and in height from 67 to 144 ft. These towers are used to exact ethane and other light hydrocarbons from pipeline natural gas. In another part of the plant, the ethane is cracked to ethylene and hydrogen, the basis for production of ethyl alcohol and, eventually, ethyl chloride, hydrochloric acid, polyethylene and ammonia.

▶**Kaskade Vs. Bubble-Cap**—J. F. Pritchard & Co., who designed and built the extraction unit (along with several other units of the Tuscola plant), made a careful evaluation of the merits of Kaskade trays before incorporating them into the Tuscola design.

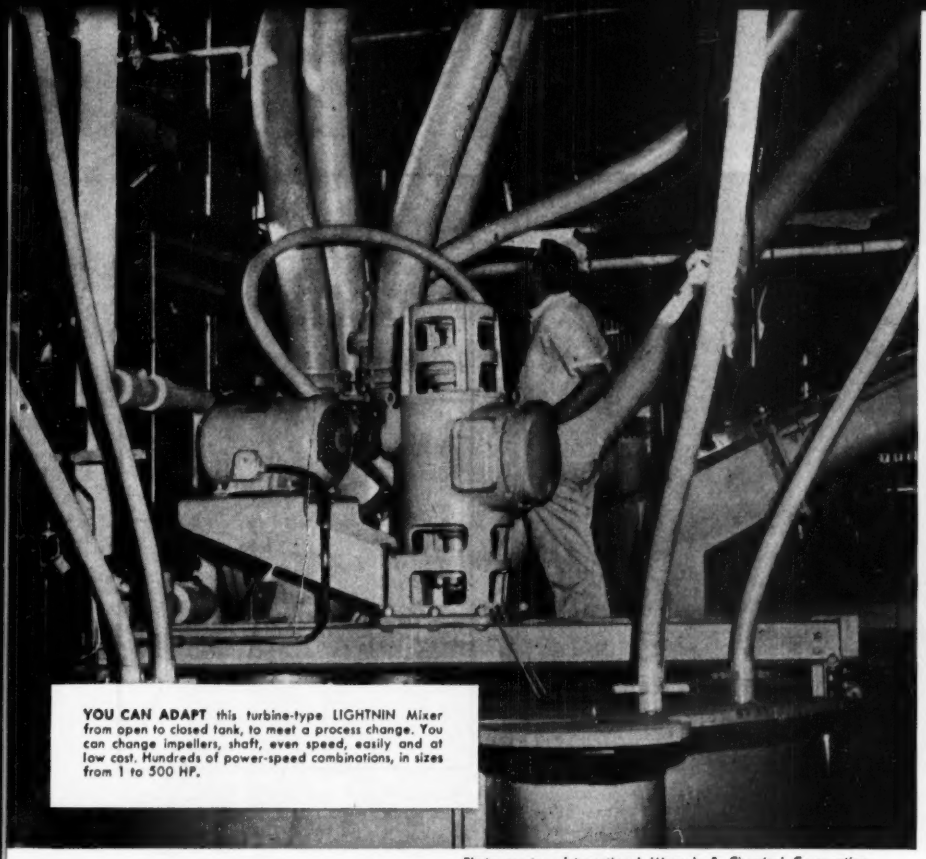
Based on previous experience with Kaskades in large gasoline plants, Pritchard specified Kaskades for the demethanizer and the two light-oil stills. Kaskades were felt to be desirable because of the high liquid loadings in these services.

Use of Kaskades in the light-oil absorbers was something of a pioneering step, as far as Pritchard was concerned. Here the decision was based on a cost reduction too big to overlook. With definite size limitations because of shop fabrication and transportation problems, three towers would have been required if equipped with bubble-cap trays. The higher capacity of Kaskade trays made it possible to do this absorption job in two towers instead of three, with savings not only in tower costs but in auxiliaries, piping and instrumentation.

▶**Increased Throughput**—The higher capacity of Kaskade trays has been Koch's chief selling point since introduction of this design to the petroleum industry in 1943. The Wichita, Kan., company claims that refiners can get 30 to 50 percent more capacity by replacing bubble-cap trays with Kaskades and has even gone so far as to guarantee a 30-percent increase on a money-back basis.

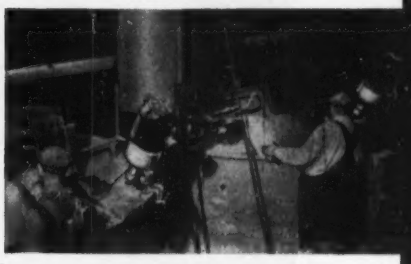
With more than 280 Kaskade installations in operation, however, upon which to base its guarantees, Koch doesn't figure on losing any money this way.

Somewhat more difficult to demonstrate is the relative mass-transfer efficiencies of Kaskades vs. bubble-caps. Koch has reams of performance data indicating better efficiencies for Kaskade trays, but efficiency calculations depend so much on the equilibrium data used and the operating conditions of the test that Koch prefers to



YOU CAN ADAPT this turbine-type LIGHTNIN Mixer from open to closed tank, to meet a process change. You can change impellers, shaft, even speed, easily and at low cost. Hundreds of power-speed combinations, in sizes from 1 to 500 HP.

YOU CAN CHANGE quickly from a mechanical shaft seal to a packed stuffing box, and back again, with this LIGHTNIN Side Entering Mixer. This means easier maintenance . . . extra protection. Tank shutoff is out in the open—easy to get at, easy to operate. Sizes 1 to 25 HP.



YOU CAN DO HUNDREDS of mixing jobs quickly with versatile LIGHTNIN Portable Mixers. Instantly make any open tank an efficient mixing vessel. More than 30 standard models with electric or air motor, direct or gear drive. Sizes ⅛ to 3 HP.

Photo courtesy International Minerals & Chemical Corporation.

Choose a fluid mixer that grows with your process

Today, this mixer is churning up 5,000 gallons of a phosphoric acid slurry.

Tomorrow, with a few simple changes, the *same mixer* may be lifting and distributing solids throughout 3,000 gallons of heavy prefilt slurry.

Or it may be whirling millions of pin-point gas bubbles into intimate contact with 10,000 gallons of fermentation broth.

Provided the horsepower requirements are not too different, you can often switch a LIGHTNIN Mixer from one operation to another, at far less than the cost of a new mixer.

7 ways to beat obsolescence

You can change the mixer mounting from open-tank to closed pressure vessel, and vice versa. You can get a new mounting to fit any tank nozzle.

You can switch from standard to low-headroom mounting, from top entering to bottom entering.

You can change shafts—even increase or decrease shaft diameter—to meet new torque requirements.

You can change size and shape of impellers—and *know in advance* what your results will be.

And with many LIGHTNIN Mixers, you can *change speed*—quickly, simply, without dismantling the mixer or even removing it from the tank. Many of these units give you a choice of up to 16 standard interchangeable speeds.

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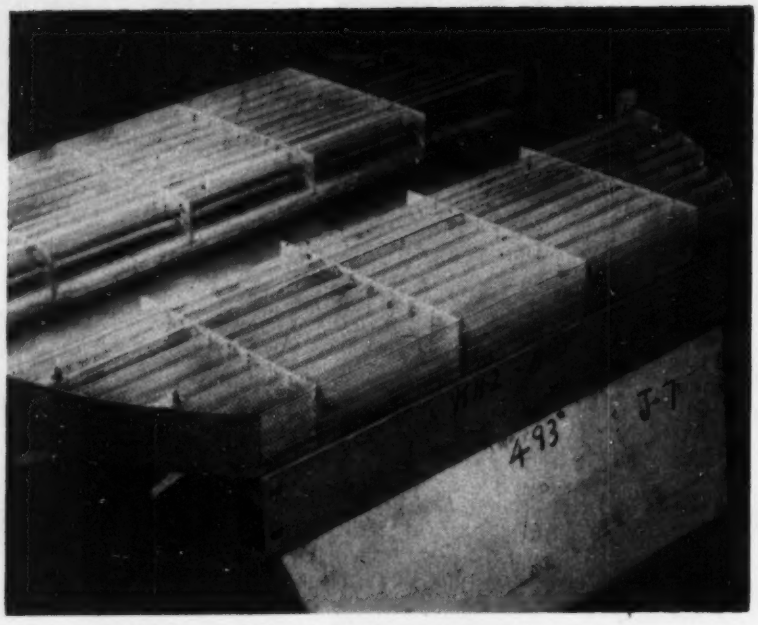
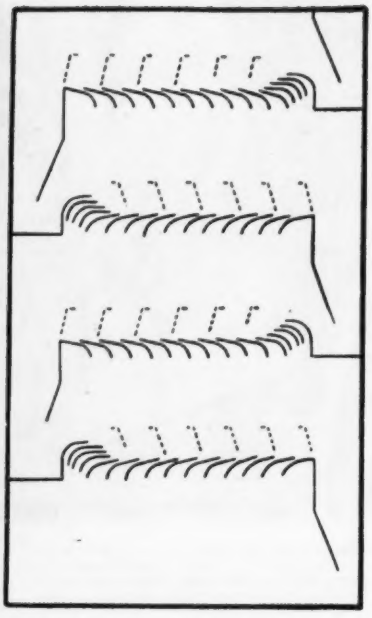


BENTURI horizontal tray design offers minimum pressure drop . . .



PERMITS tray spacings as low as 7 in.

concentrate its sales pitch on capacity factors.

▶ **Tuscola Performance**—The table below gives the design basis of the Kaskade and bubble-cap towers in NPC's extraction unit.

NPC engineers have just run some performance tests on these towers. R. V. Safford, chief technologist at Tuscola, reports that they were able to maintain an oil flow to each light-oil absorber of 1,000 gpm., considerably over the design rate. At that, the flow rate was limited by pump capacity. Extrapolating to maximum rate, Safford predicts a throughput of 1,200 gpm. is possible and hopes to verify this figure shortly.

The design gas rate of 139,000 scfm. per light oil absorber was the maximum available during the recent test. But Safford expects that when gas is available they can run at 160,000 scfm. This, of course, is not yet verified.

As to separation efficiency, the NPC test on the light-oil absorbers showed 12 theoretical trays, for a tray efficiency of 12/26 or 47 percent. This is an acceptable figure for this type of operation.*

▶ **Now Horizontal**—In Fred Koch's original Kaskade tray, patented in 1946 (U. S. 2,401,569), the liquor flowing down the tower follows a zigzag path made up of a number of steps inclined at 45 deg.

About four years ago Koch introduced a horizontal design (U. S. patents pending) which incorporates a new principle and offers additional advantages.

In the new design the liquor flows horizontally across the tray. The vapor passages, although slightly curved, have a venturi-type cross-section. Koch calls this the Benturi design, from "bent venturi."

From the standpoint of fluid-flow theory, the venturi-shaped risers offer minimum pressure drop, a factor especially important in vacuum distillation. Pressure drop for a given degree of fractionation is said to be extremely low—as little as 1 mm. Hg per tray.

The horizontal tray offers other advantages. It permits tray spacings as low as 7 in. Installation and cleaning are easier. It is suited for liquid-liquid extraction jobs, especially in those difficult situations where the gravity difference between the two liquid phases is less than 10 percent.

▶ **Free-For-All Battle**—Other challengers for the bubble-cap tray's crown are joining in the battle. Shell's new Turbogrid tray, already well entrenched in Shell's own operations, is being actively promoted by several engineering firms. The old sieve tray, long neglected because of inadequate design data, is now getting some of the attention it deserves. The Kittel

*Koch reports that five 3-ft.-dia. narrow-cut naphtha fractionators at Roosevelt Oil Co., Mt. Pleasant, Mich., using Kaskade trays, show efficiencies "well over 100 percent."

Dimensions and Design Loads for NPC Extraction Unit

	Light Oil Absorber	Heavy Oil Absorber	Demethanizer	Light Oil Still	Heavy Oil Still
Type of trays	Kaskade	Bubble	Kaskade	Kaskade	Bubble
Number of towers	2	3	1	2	1
Diameter, in. I. D.	114	102	126	96 (top) 138 (bot.)	54 (top) 84 (bot.)
Number of trays (excluding draw-off trays)	26	19	15	29 (top) 10 (bot.)	10 (top) 13 (bot.)
Over-all height, ft. (including skirts)	96	65	67	144	77
Operating pressure, psi.	490	480	405	290	60
Temperature at top, deg. F.	−7	61	75	140	240
Vapor load, scfm. per tower	139,000	84,000	24,000	33,500	3,200
Vapor load, ft./min. at tower conditions	53	47	10.5	40 (top)	57 (bot.)
Liquor load, gpm. per tower	850	150	3,750	4,290	1,900
Liquor load, gpm./sq. ft. of tower cross-section	12	2.7	43	41 (bot.	49 (bot.)

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The non-drying properties of Oronite Polybutenes make them useful in conjunction with oils and fillers in permanently pliable sealing compounds. Their low temperature flexibility characteristic makes them ideally suited as binders in both knife grade and gun grade types of calking compounds, or the related sealing, insulation or sound deadening mastics. Being competitive in cost with most blown vegetable oils, a proper balance of fillers, oil and Oronite Polybutene can provide most any desired characteristic. Being natural moisture barriers they improve the water resistance of crack-sealing compounds. Write any Oronite office for complete information.

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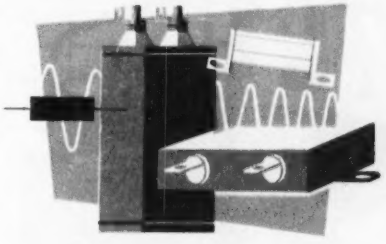

ELECTRICAL INSULATION

Oronite Polybutenes offer superior dielectric strength, low expansion coefficient and low power factors—all essential in paper-insulated electrical products. Their low power factor values, over a wide frequency range, make them useful as a dielectric in condensers and capacitors. Stability of this power factor is maintained over long periods of time.

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Dispersant NI-W	Ortho-Xylene
Wetting Agents	Xylol
Cresylic Acids	Aliphatic Acid
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2875

tray, made of low-cost expanded metal, has recently been introduced in the U. S.

New developments in packings may even swing some tower designs away from trays altogether. The Intalox saddle and the still-experimental Rosette have aroused new interest in packed towers. Panapak wire-mesh packing, announced in 1949, deserves more consideration than it has received, think some chemical engineers.

There's still more competition in devices for performing liquid-liquid extractions. Agitated and pulsating columns, centrifugal contactors, compact mixer-settlers, all are vying for the process engineer's favor.

Whatever the outcome of the battle might be, the Kaskade tray is going to put up a good fight.

Don't Count Bubble Caps Out

Commercial-scale test data now point the way to higher capacities, improved efficiencies, better operating performance and lower first cost.

Performance data from large experimental towers—such as the one shown here—are helping the bubble-cap tray in its fight to maintain top position in the petroleum and chemical industries' fractionators and absorbers.

This particular tower belongs to C. F. Braun & Co., engineering firm of Alhambra, Calif. As a test installation it represents a sizable piece of change, both in first cost and operating expenses. Is it paying off?

Turn the page for a moment and look at the first chart. For an assumed case—a typical cyclohexane fractionator—Braun figures the information it has developed over the past six years would reduce today's cost of this one hypothetical tower by $60,000, compared with what a tower for the same job would cost using design data available in 1948.

▶ **Older Data Too Limited**—For 25 years prior to 1950, Braun engineers studied partial tray sections in the laboratory and commercial columns in the field. As a result of these studies they concluded that data so obtained were too limited in application. They decided to build their own commercial-scale test unit, capable of supplying a much wider range of data.

Principal pieces of equipment are: A 66-in.-dia. test column, 18 ft. high; vapor surge tank, 72 in. dia. and 12 ft. high; 150-hp. blower for circulating vapor; 15-hp. pump for circulating liquid; and a liquid cooler.

For studies on bubble-cap trays, the column usually contains three trays. Braun equipped these trays for measuring pressure drop, hydraulic gradient, entrainment, liquid level in downpipe, and so on. In addition, the column has windows on the sides and top for visual studies.

The unit can operate over a wide range of liquid and vapor rates. Maximum liquid rate is about 550 gpm.; top vapor rate is 16,000 cfm. Studies have included a variety of hydrocarbon systems.

In operation, vapor passes from the top of the tower into the surge tank, where liquid droplets settle out. The vapors then go through an orifice run and back to the suction side of the blower. Liquid is circulated from the bottom of the column through the cooler and to the top tray. The cooler maintains constant temperature conditions in the column.

▶ **Performance Factors**—As reported by Ralph Young to the California Natural Gasoline Association in January, Braun engineers have studied six conditions that limit satisfactory performance (*see second chart*):

• **Pulsation** results when vapor flow through a tray is so small that the caps pass vapor intermittently. Intermittent vapor flow causes pulsation on the tray and results in poor vapor-liquid contacting. A secondary effect is that between surges of vapor through the caps, liquid dumps through the risers to the tray below. Braun has established the influence

ionXchange

Ferric iron removed from hydrochloric acid

Illco-Way laboratory develops economical process to remove ferric iron from hydrochloric acid by ionXchange. Only water needed to regenerate resin.

Removal of ferric iron from hydrochloric acid by ionXchange is both economical and commercially feasible.

The method, developed in Illco-Way's laboratory during recent studies of solution purification, involves passage of the acid through a tank properly lined and containing ionXchange resin.

The process is interesting, especially from the standpoint of economy, since only water is used to regenerate the resin. The only costs involved are for resin amortization and slight acid losses.

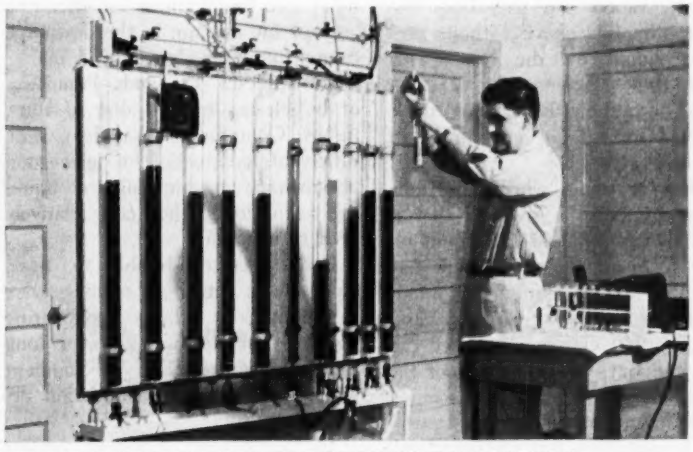
In developing the process, Illco-Way technicians recognized that the usual iron contamination in hydrochloric acid existed as a complex anion ($FeCl_4^-$). The problem was to find a suitable anion exchange treatment for commercial operation. After many trials in the laboratory, treatment was discovered. After treatment, the acid is water-white, its iron content less than 0.1 ppm. If ferrous iron exists, free chlorine can be used to oxidize the ferrous iron to the ferric state. Any chlorine residuals will be removed by the resin. Sulfates or sulphuric acid are not removed by the chloride form of the anion exchange resin.

As a result of these studies in the laboratory, ionXchange equipment has been developed for plant scale operations by hydrochloric acid manufacturers. Illco-Way, with its wide experience in the industrial field and its long background of ionXchange pioneering, is uniquely equipped to work out the development of a problem from pilot plant to actual process stage. Write for full description of methods, equipment, and installations.

ECONOMICAL PROCESS

Treatment for complete removal of iron from hydrochloric acid costs only 6¢ per thousand gallons for resin amortization. (Loss in acid is approximately 3 gallons per thousand gallons treated.)

These costs are for a typical technical grade (18-22° Be′) hydrochloric acid containing 100 parts per million iron. If the iron content is less than this, costs will decrease proportionately.



PURIFICATION STUDIED IN ILLCO-WAY LABORATORY

Investigation of solutions requiring purification is carried on in a completely equipped ionXchange laboratory. It is maintained by the Illinois Water Treatment Company for study of process problems on a laboratory to pilot plant to process basis.

ILLCO-WAY

ionXchange

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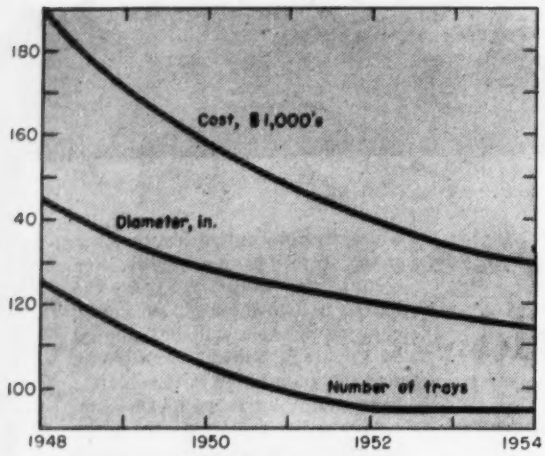
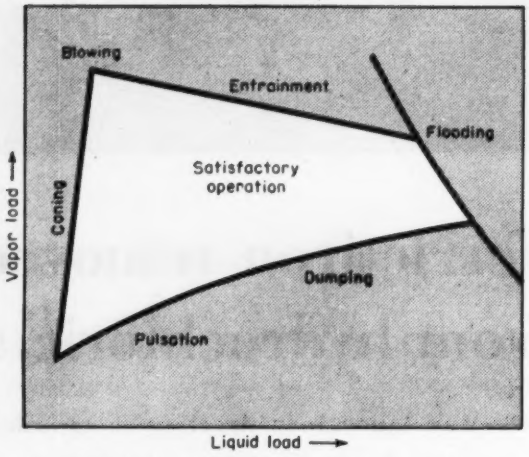


SAVINGS made possible by better design data reflect both reduced diameter and fewer number of trays required.



SIX FACTORS which limit satisfactory tray performance were studied in large-scale test column.

of three factors on pulsation—cap size, slot area and properties of the fluids.

• **Dumping** occurs at relatively high liquid loads when some of the upstream caps don't pass vapor. Liquid dumps through the risers of the caps that aren't operating, decreasing tray efficiency.

Heretofore, according to Young, hydraulic gradient has generally been suspected as the cause of dumping. Many engineers figured that when the hydraulic gradient above a row of caps exceeded the pressure drop through the caps, the caps stopped bubbling and liquid dumped through the risers to the tray below.

Braun now claims from its findings that hydraulic gradient has little effect on dumping. Major cause is said to be the kinetic energy in the liquid stream as it leaves the downpipe and enters the tray. When the energy in this stream is greater than the vapor driving-force across the caps, the liquid will dump to the tray below. This conclusion comes from tests of several types of tray layouts, using different numbers of cap rows, and a variety of hydrocarbon systems.

Having pinned down the cause, Braun now comes up with a proposed remedy—an inlet dam upstream of the first row of caps. This dam prevents liquid from impinging on the caps and reduces the vapor flow required to prevent dumping. This is a new application of a rather old device.

Location and height of the dam are critical. Use of an improperly designed dam can cause poor liquid distribution and can decrease tower capacity. However, says Young, when using a properly designed inlet dam in many cases it is actually impossible to make a tray dump.

• **Coning** occurs when the combination of weir height and liquid crest over the weir doesn't adequately seal the cap slots. If the slots aren't sealed properly, vapors can pass from the caps to the tray above without contacting liquid on the tray. This knocks tray efficiency for a loop. Braun's tests show that a liquid static seal of ½ in. will prevent coning in most cases.

• **Blowing** results when vapor flow through the caps is so great that it literally tears holes in the liquid on the tray. Again, the effect is low tray efficiency. Braun finds that four things affect blowing—size of caps, slot area, skirt clearance between cap teeth and tray, and properties of the fluids.

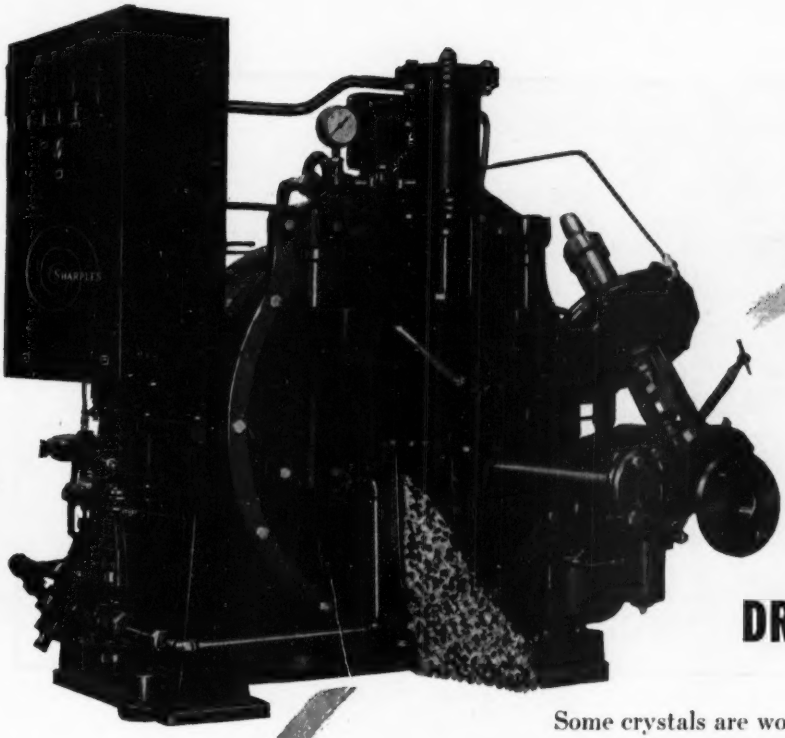
• **Entrainment** causes off-grade overhead product, low tray efficiency and, possibly, low column capacity. Young classifies entrainment in two types—a relatively fine mist carried to the tray above by superficial vapor velocity, and large droplets of liquid jetted from one tray to the next. The latter type occurs at high vapor rates and is greatly influenced by tray spacing, size and type of bubble caps, tray layout, fluid properties and liquid rate. Braun's work shows that air-water tests alone can't be used to predict entrainment for hydrocarbon systems.

• **Flooding** occurs when the level of liquid-foam mixture in the downpipe builds up and overflows to the tray above. Flood-point is computed from pressure drop, hydraulic gradient, liquid rate, head loss in the downpipe and aeration factor. The aeration factor is used to determine the operating level of the mixture in the downpipe from a computed clear liquid level.

► **Meeting New Demands**—Popularity of bubble-cap trays is due to three things: Columns can handle a wide variety of feedstocks; they give good performance at wide ranges of liquid and vapor loads; they cost relatively little to maintain.

Early uses of bubble-cap trays, especially in petroleum refining, were in applications where fractionating ability wasn't critical. For a long time comparatively little development work was done on fractionation devices.

In recent years, however, refiners have tightened up on product specifications and equipment costs have soared. As a result, designers and operators have been turning to new and improved types of trays. Braun's current work on the bubble-cap tray proves that there's plenty of life left in the old girl yet.



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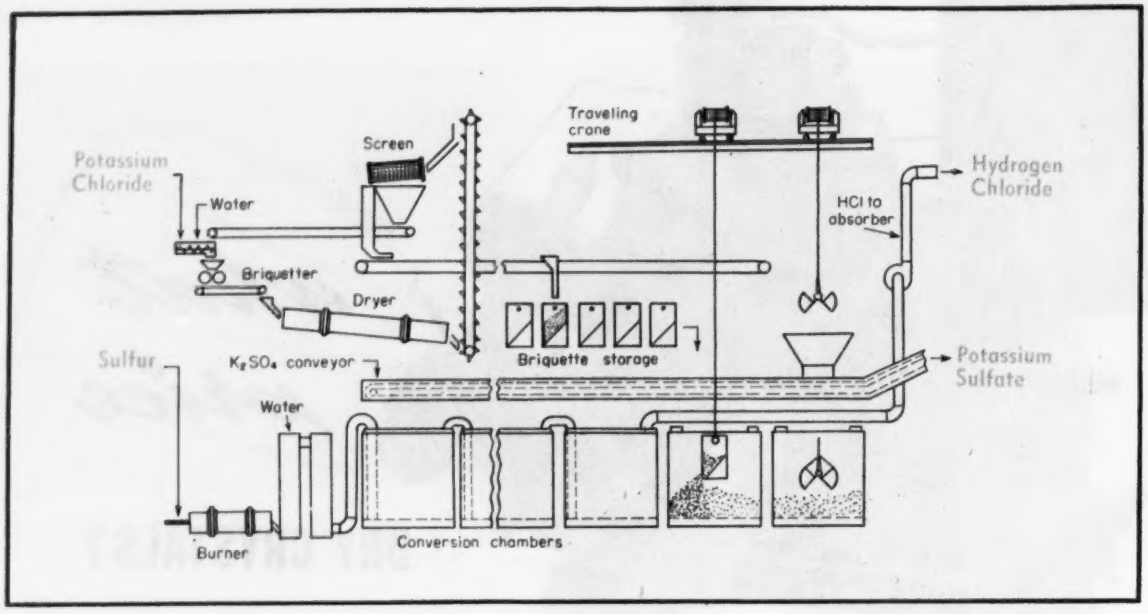
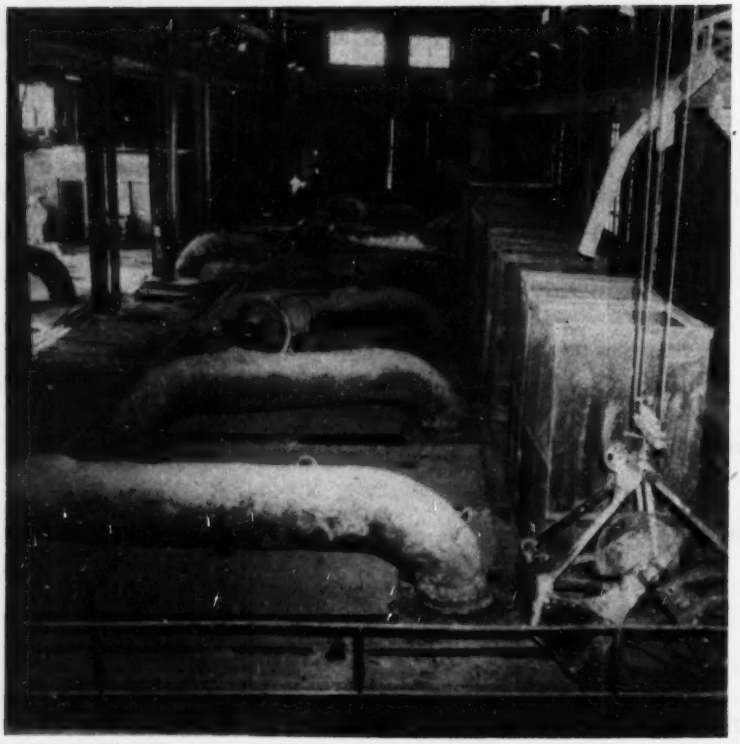


FOR VETERAN HARGREAVES PROCESS . . .

A New Job in the Potash Industry



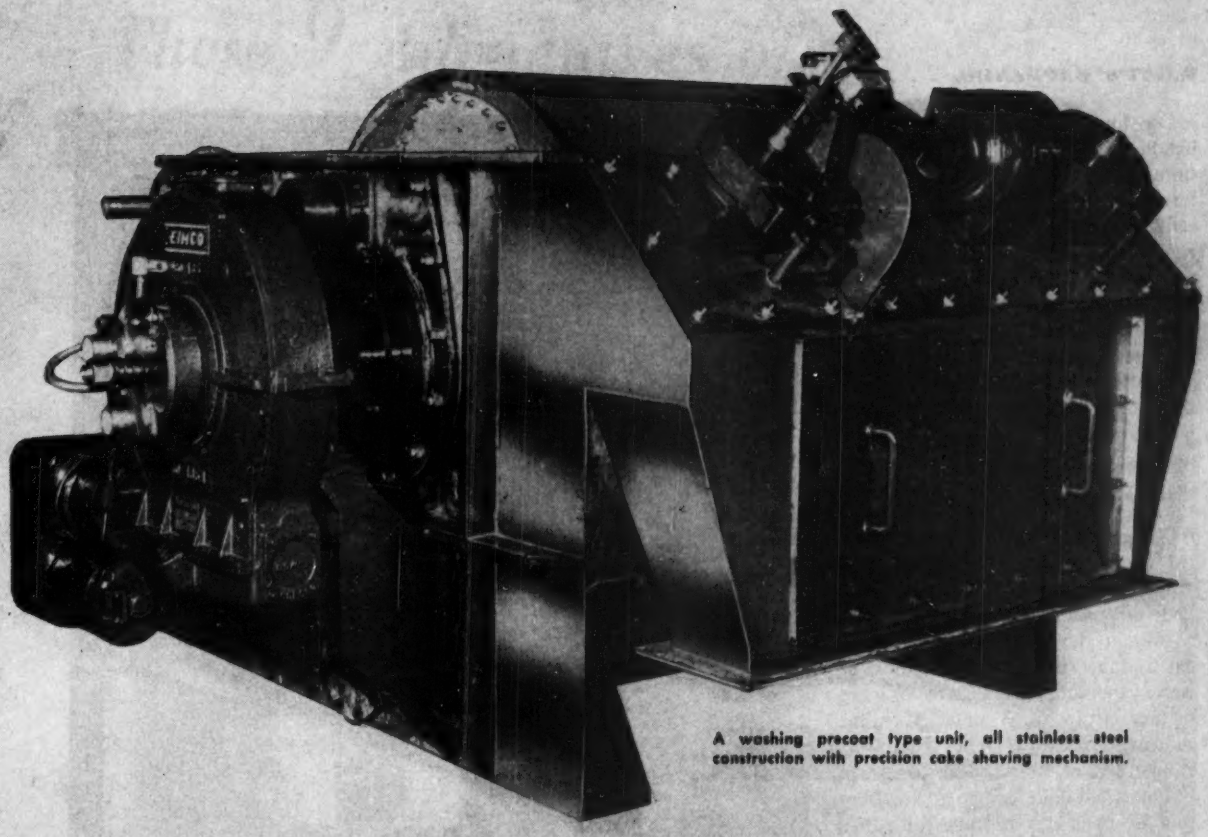
CONVERSION chambers linked by gas ducts are charged from KCl storage boxes.

Near Dumas, Tex., the veteran Hargreaves process is once more making a name for itself. Potash Co. of America has revealed successful operation of a plant for producing potassium sulfate and hydrochloric acid directly from sulfur and potassium chloride. It's believed to be the first application of the Hargreaves process in the potash industry.

Impetus for this development came from the farmer. Potassium sulfate is a preferred fertilizer for tobacco and other specialty crops.

Yet before the plant could be built a market had to be found for co-product HCl. A market study convinced Potash Co.'s management that there was a good existing and future market for HCl in oil well acidizing.

▶ **Raw Material Shift**—Dumas, Tex., was spotted as a centrally located marketing point for oil-field acid. As a manufacturing site it could be supplied with potash by rail from PCA's mine and refinery at Carlsbad, N. M. It did not, however, lie within range of an available supply of sulfuric acid, required for conventional potash conversion using a Mannheim furnace.



A washing precoat type unit, all stainless steel construction with precision cake shaving mechanism.

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Specialized Eimco filtration units do a better job than standard filtration units where the metallurgy is complicated and the savings are critical.

Here is another typical example of a specialized application where Eimco design and construction played an important part with a consequent greater saving to the customer.

The subject plant was using standard filter press equipment for extraction of a valuable copper sulphate solution from the slurry. A 2% copper sulphate content in the feed was filtered on a unit similar to the one pictured and reduced the CUSO4 to less than 0.5% where as the best obtainable in the presses had been between 0.6—0.7%. Flow rates on the filtrate were increased from .8 gallons/sq. ft./hr. to 4—4.5 gallons per sq. ft. per hr. on a 24 hour basis. Clarity of the filtrate from the Eimco unit was better at all times. Less wash water was used with a resultant lower dilution factor.

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On the other hand, the Texas panhandle area could offer a supply of sulfur made from hydrogen sulfide extracted from natural gas. That logically led to choice of the Hargreaves process to utilize raw sulfur directly instead of sulfuric acid.

PCA's plant at Dumas was designed for a potassium sulfate output of 60 tons per day. During the three years since startup in April 1951 many technical and operational difficulties have been overcome to bring the plant to rated capacity. Now, output is reported to be somewhat over the design figure.

▶**Gas and Briquettes**—In the process, gas containing sulfur dioxide, excess air and water vapor is passed through beds of potassium chloride briquettes to obtain the desired reaction. The gas contains slightly over one mole of water vapor and one-half mole or more of oxygen for each mole of sulfur dioxide. Process gas comes from a sulfur burner.

Potassium chloride is prepared from fine (80 percent −100 mesh) material with a purity of approximately 96 percent. The fine crystals are mixed with water in a pug mill, then discharged into a briquetting machine. Briquettes are formed in the shape of almonds measuring 1¼ in. maximum dimension.

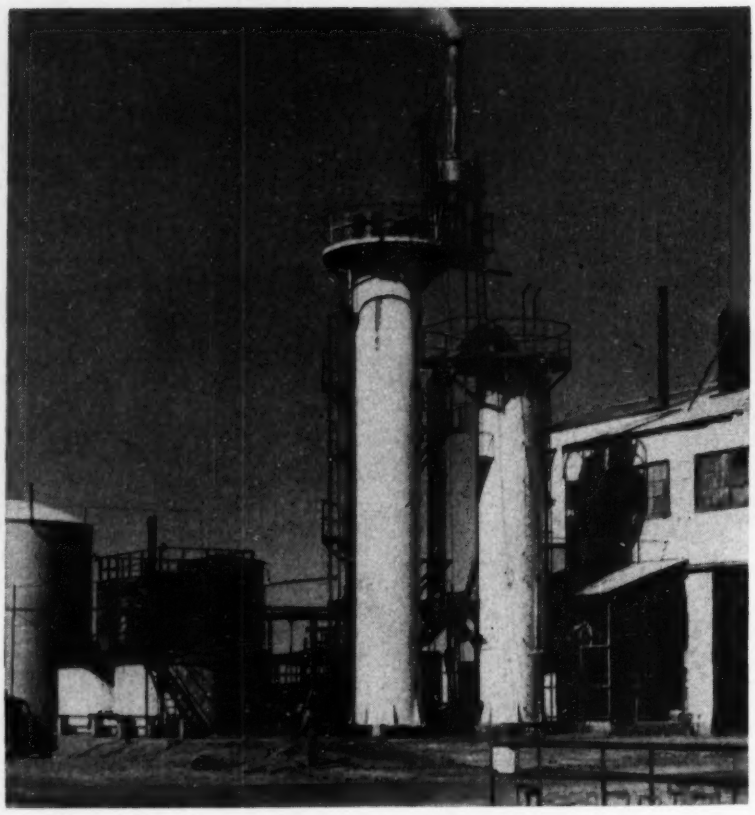
Once formed, the briquettes are dried and screened. Whole briquettes are transferred to storage baskets; broken briquettes and fines are returned to the briquetting circuit.

The reaction takes place in a number of chambers connected in series. Each chamber holds approximately 80 tons of potassium chloride briquettes.

▶**Chamber Preheated**—After a chamber has been filled with fresh briquettes it is preheated by air drawn through a hot, completely reacted chamber just removed from the circuit. Normally, this procedure elevates the charge to reaction temperature. Then the chamber is switched into the main gas stream.

Gas flows through the line of reactors starting with the most completely reacted and ending with the most recently added and unreacted chamber. In a sense it's a countercurrent flow.

Each time a chamber is cut off the line, or added, piping is switched to maintain the gas flow pattern indicated above.



PACKED towers strip HCl from offgas making 20 Be. acid for oil field use.

Converted potassium sulfate briquettes contain less than 2 percent chloride and are practically acid free. After cooling they are removed from the chamber with a clam-shell crane. Size reduction is handled in a swing hammer mill before bulk shipment in box cars.

Offgas from the reaction chambers, containing HCl, is passed through packed towers countercurrent to a flow of water. Acid formed in these absorbers circulates through impervious graphite coolers in order to control tower temperature. Rate of water addition is regulated to give a high-purity finished acid containing 31.5 percent HCl (20 Be).

▶**Checkrein Needed**—Successful operation of the process is tied very closely to careful temperature control throughout the reaction chambers. Operating temperature must be held within the narrow band between a satisfactory reaction temperature and the fusion point of the eutectic mixture.

Since the reaction is exothermic, heat generally must be removed from the circuit by radiation or direct dilution of the gas with cold air. If the reaction rate slumps then heat can be added as needed.

Potash Co. likes the Hargreaves process better than the Mannheim process. Not only does it use raw sulfur, rather than sulfuric acid, but also conversion and recovery efficiencies normally exceed 95 percent. And the process is readily adaptable to large tonnage production.

Consumer acceptance of the granular, acid-free sulfate has been enthusiastic. The hydrochloric acid output is generally of higher quality than that produced by the Mannheim process in making the same conversion.

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5. **Low make-up**
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7. **Reduced operating hazards**
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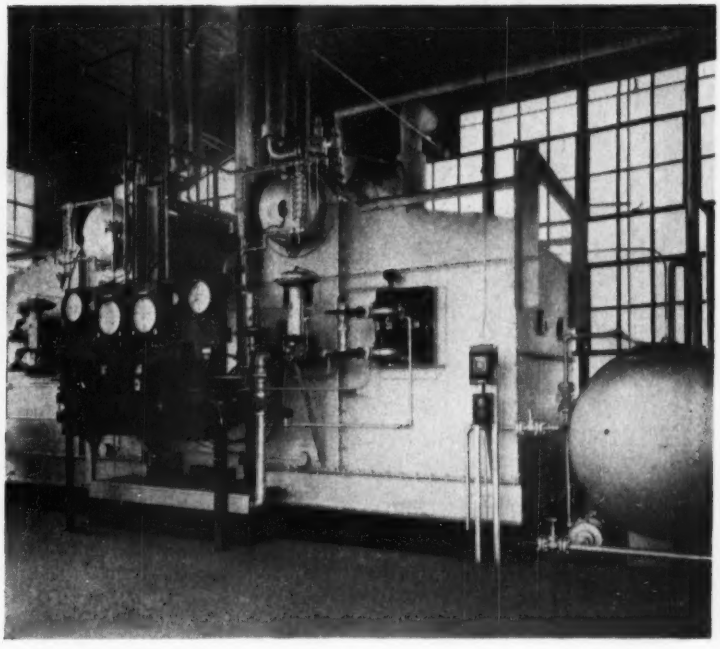
9. **Fully automatic operation**



MANY production men are familiar with these advantages of modern high-temperature heating systems. Yet only too often the considerable technical knowledge and experience needed to design and construct the specialized equipment—by which cost reductions and product improvement may be realized—are not given adequate consideration.

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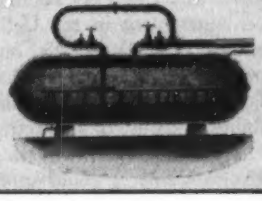
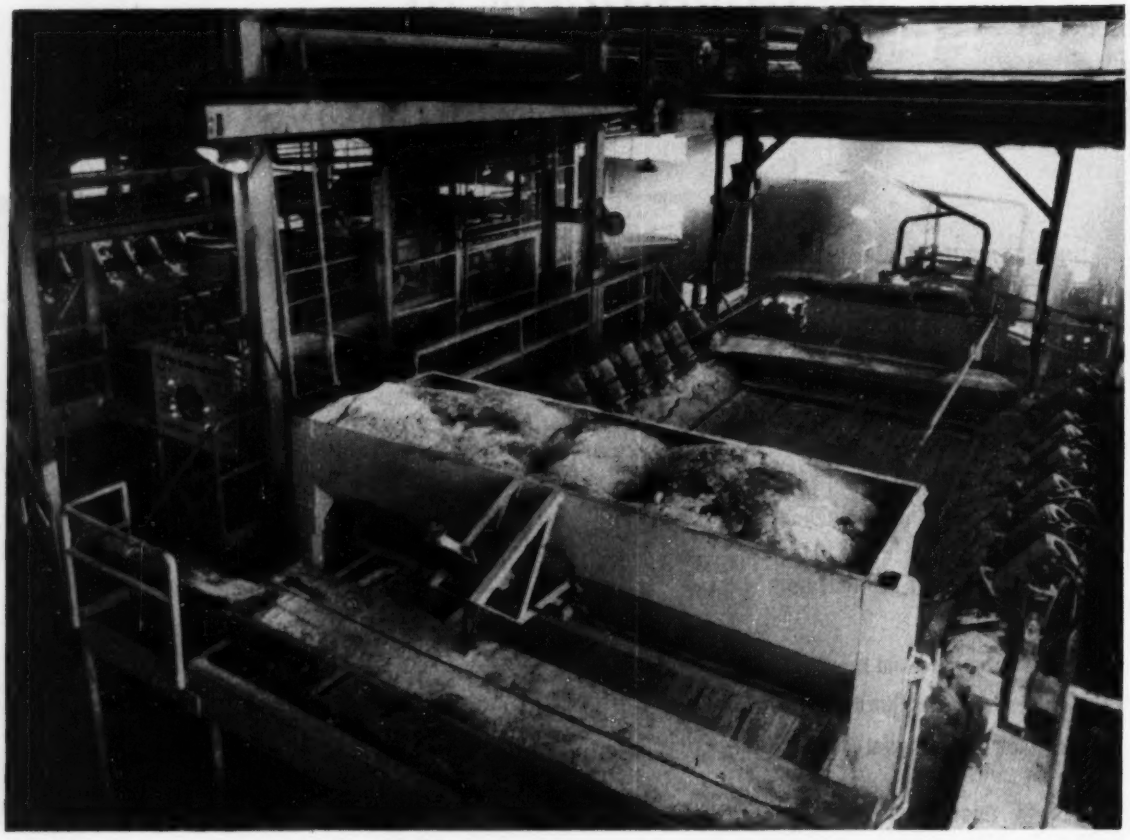




CARBON electrodes, seen here on either side, now are gone, since . . .

Electric Glass Furnace Uses Moly Electrodes

Melting glass by passing an electric current through it has proved out economically. Remodeled furnace boasts greater flexibility, longer life expectancy.

Northwestern Glass Co., a pioneer of electric furnaces for glass production, has recently remodeled the all-electric furnace shown above. Using molybdenum electrodes instead of carbon, the revamped furnace can now turn out flint glass as well as amber glass.

With this move the Seattle company, which in 1945 became the first container plant in the U. S. to melt amber glass electrically on a commercial basis—and is still alone in this field—has now added significant flexibility to its use of all-electric units.

Previously, Northwestern's two all-electric furnaces could produce only amber glass (which accounts for about 40 percent of the company's output). A combination oil-electric furnace—also the first of its type in this country—produced all the flint glass, at a rate of 70 tons per day.

▶ **Electrodes Through Wall**—The two rows of large carbon electrodes that formerly protruded from the top of the remodeled furnace are gone; in their place are small-diameter molybdenum electrodes extending into the furnace through the sidewalls. This arrangement had been used successfully with carbon electrodes in the combination oil-electric furnace.

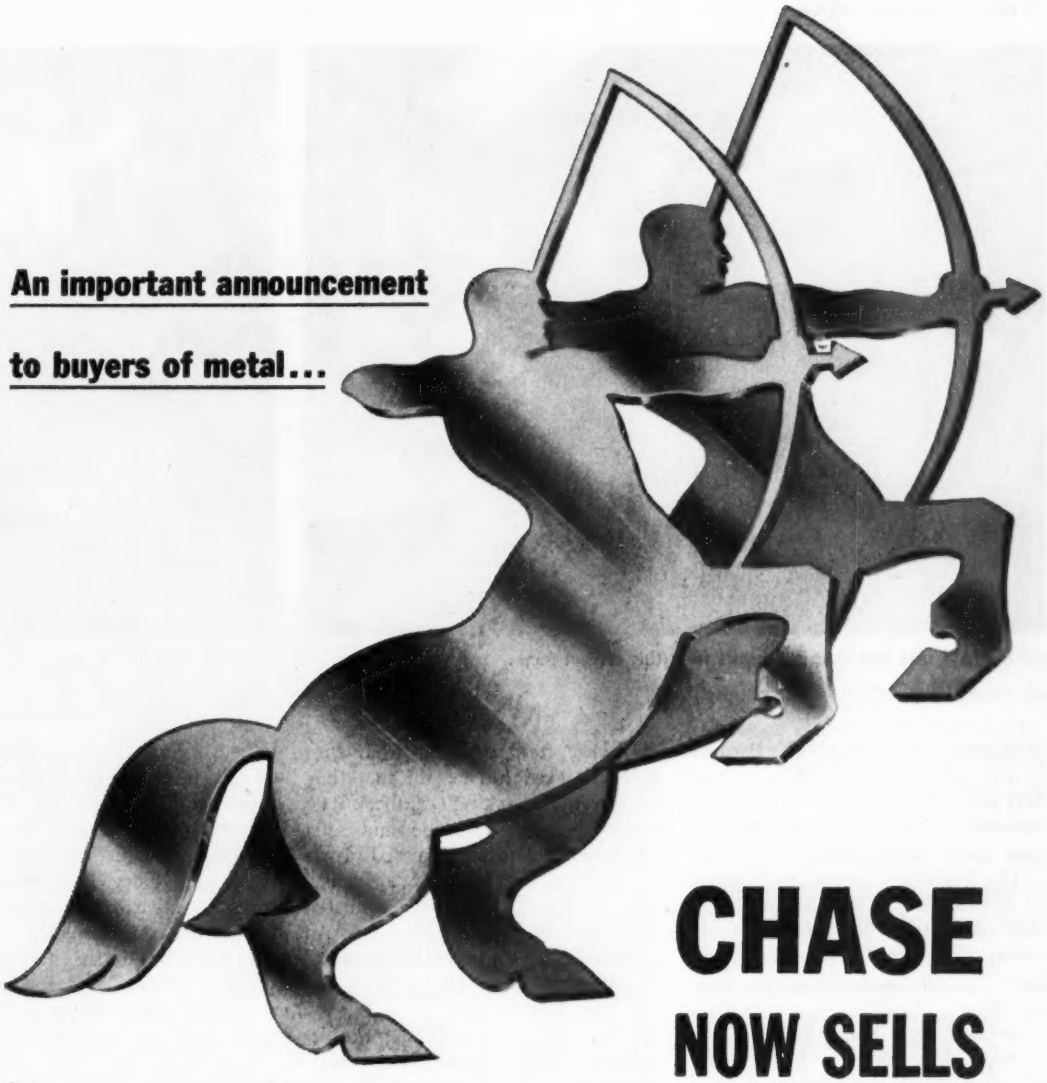
Molybdenum makes better contact with the hot glass melt; carbon tends to repel the glass. The moly electrodes, therefore, need not be as large as the carbon electrodes. Insertion of the electrodes through the sidewalls permits use of virtually the entire melting surface for heating, something that was impossible when the carbon electrodes passed through the batch blanket.

▶ **Longer Life**—Although moly electrodes cost more than carbon, Northwestern expects the extra investment to pay off in longer life.

Average life of carbon electrodes has been so variable that the production people couldn't maintain any set schedule. With the new electrodes the company expects to capitalize fully on the three-year life of the all-electric furnace. When used in amber glass production moly electrodes should operate the entire time between furnace

An important announcement

to buyers of metal...



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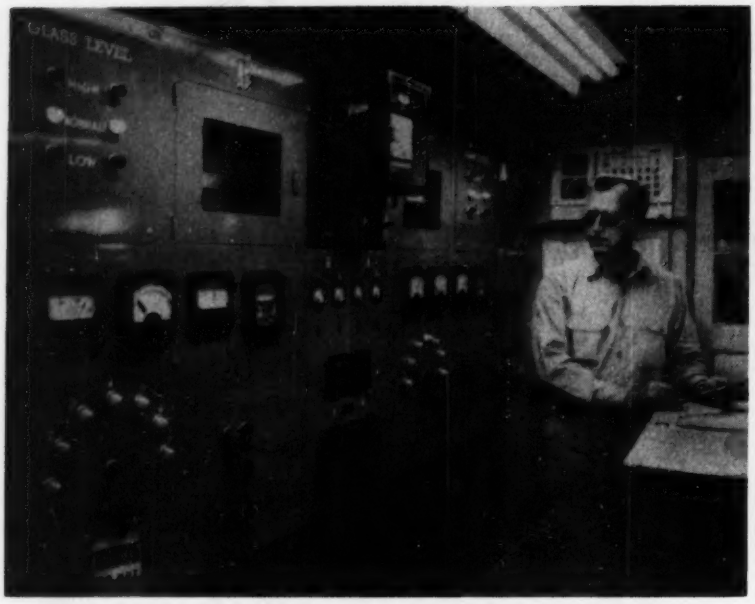
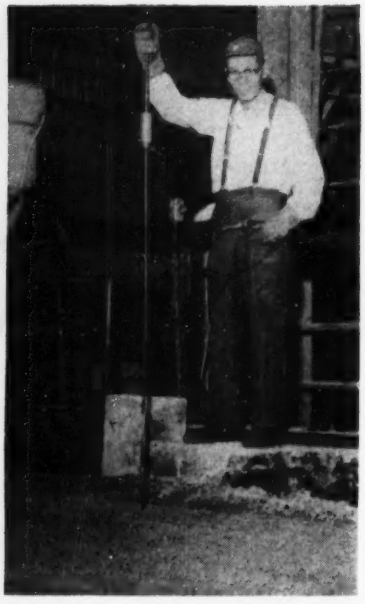


ONE MAN runs two electric furnaces from this control room.



TAKING the temperature of a batch.

shutdowns for renovation. Because of increased oxidation when making flint glass, however, life of the moly electrodes will be somewhat shorter than when making amber.

The remodeled furnace gives promise of exceeding its previous maximum daily output in the production of amber glass (and more flint glass than the combination furnace could handle).

In addition, the product is of high quality, with a high degree of homogeneity and freedom from "seeds" (small gas bubbles). Electrically melted glass also has fewer "stones," which are caused by bits of refractory, sand particles or drippings from the top of a conventional furnace.

▶ **Electric vs. Fuel-Fired**—Northwestern converted to electric melting after having used oil for some 13 years. With natural gas unavailable in the Seattle area and with oil prices increasing, the company determined to use the plentiful, low-cost hydroelectric power that is one of the area's assets.

Eight years' experience has proved that electricity, although now not much cheaper as an energy source in the Pacific Northwest than fuels, makes possible an increase of at least 5 percent in production efficiency and produces better glass.

Electric furnaces differ from conventional glass furnaces in that they have open-top melting chambers. Raw materials—sand, limestone and soda ash, plus 20 percent reclaimed glass—are fed in the form of a blanket which serves as a well insulated cover for the melting chamber. An automatically controlled mechanical spreader maintains the glass at the optimum level.

Other advantages are that the designer can place electric heat exactly where he wants it and that the operator can control it with a high degree of accuracy. A single operator controls Northwestern's two electric furnaces from a glassed-in booth located between them (*see cut*).

An electric glass furnace is less bulky than a conventional oil or gas-fired furnace. Thus Northwestern, with three furnaces (including the combination oil-electric), still has room for expansion in less space than a conventional glass works of equal capacity.

▶ **First and Running Costs**—First cost of an electric furnace is said to be lower than a conventional furnace. Maintenance costs are decreased by simpler design and the need for fewer vulnerable parts.

Thermal efficiency of the all-electric furnace is over 60 percent, compared with about 15 percent for oil firing. Where electric heat is superimposed on oil firing, as in Northwestern's combination furnace, it's utilized at practically 100 percent efficiency.

Temperature in the electric furnace reaches 2,650 deg. F. under the batch blanket. High temperature requires adequate thermal insulation. Actually, the insulation is so effective that a power failure of 30-45 min. causes no concern. Shutdowns as long as 8 hr. have occurred without freezing the 90-ton mass of glass in each furnace.

▶ **Combination Oil-Electric**—The present combination furnace was originally designed by Toledo Engineering Co. as an end-port oil-fired unit. Northwestern did the conversion job. The change-over increased production 27 percent, with an increase of only 10 percent in fuel cost.

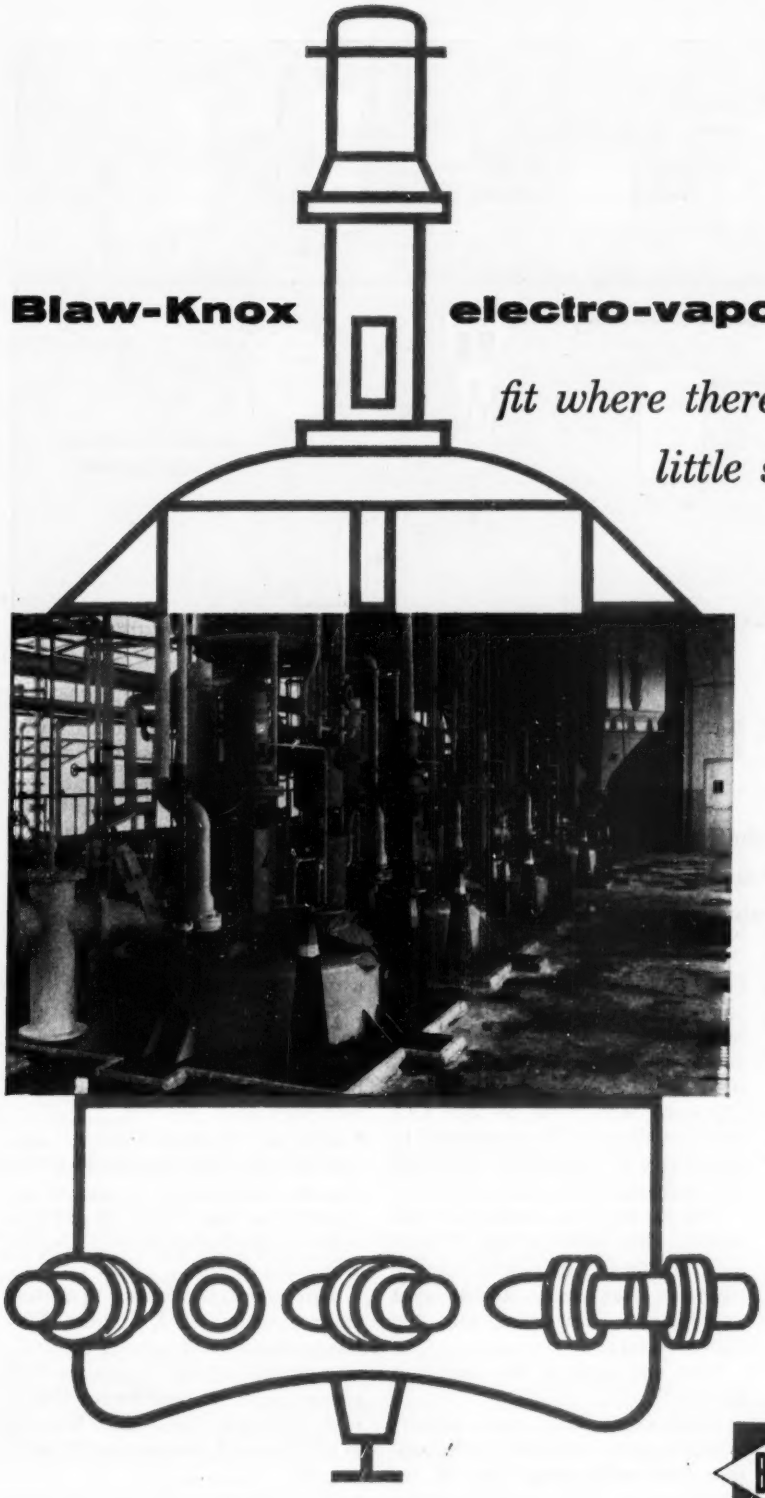
In this furnace cold batch moving in on the surface of the melt is simultaneously heated by oil combustion from above and electricity from below. This results in rapid melting, achieving a desirable stirring action and leaving more time for refining.

In all Northwestern furnaces the heat is developed by passing up to 10,000 amp. at a maximum of 200 v. through the molten glass between banks of electrodes. Each furnace draws approximately 1,250 kw. Power required per ton of glass melted is about 1,000 kwh.

Blaw-Knox electro-vapor kettles®

fit where there's

little space to spare



Blaw-Knox Kettles, heated by efficient, Electro-Vapor Systems, are compact, completely self-contained units. There are no costly, space-consuming boilers, pumps or piping systems to install or maintain.

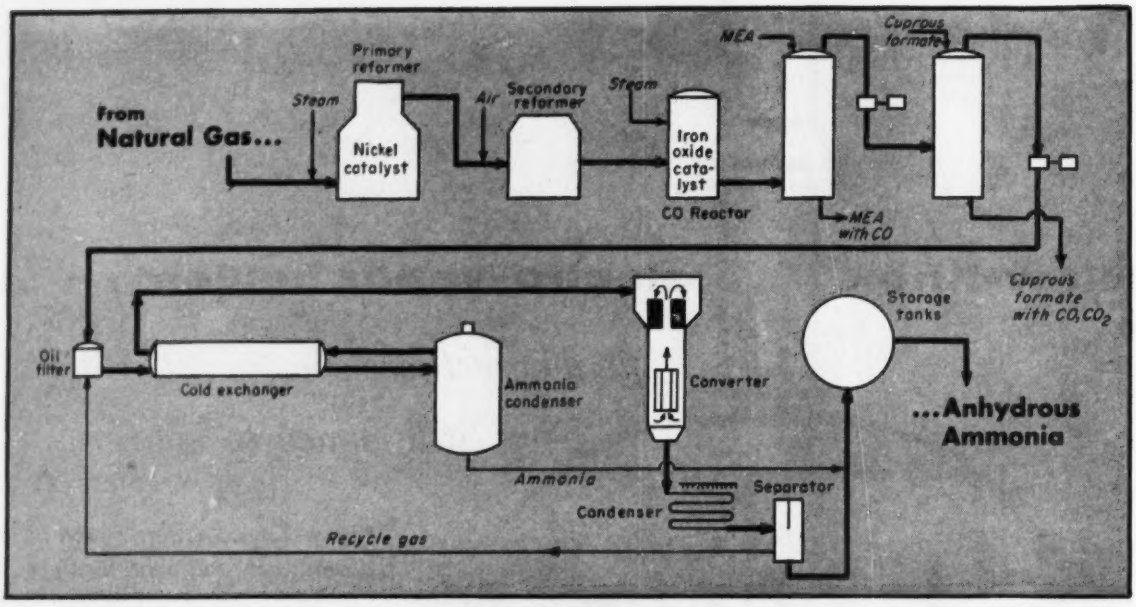
From a cold start, the electrically heated Dowtherm vaporizer quickly brings the kettle to the desired operating temperature. The heat is uniform and accurately controlled throughout a wide range of temperatures up to 700°F. Explosion resistant, submerged heaters permit safe operation even where volatile solvent vapors are present.

For additional information, write for Blaw-Knox Bulletin No. 2324. There's no obligation.

BLAW-KNOX

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Process Equipment Department
Pittsburgh 38, Pennsylvania



Ammonia—How It's Made Today

The latest word in synthetic ammonia plants. That's the new Phillips Chemical unit at Adams Terminal. Designed by Chemico, it's compact, streamlined and efficient.

Phillips Chemical Co. recently brought a modern synthetic ammonia plant on stream, at its Adams Terminal on the Houston Ship Channel—just outside of Houston, Tex. Engineered and designed by Chemical Construction Corp., it's a 450 ton per day unit—and will double Phillips ammonia output. The latest concepts of chemical engineering design have gone into the building of the plant.

Keeping in step with a modern trend—the unit feeds on natural gas. It's expected that in a few years fully 90 percent of ammonia made in this country will be synthetic. And 75 percent of the synthetic will be from natural gas.

▶ **N.E.C. Process**—Chemico's ammonia synthesis is based on the N.E.C. medium pressure (350 atm.) process. This was developed by Nitrogen Engineering Corp.—which became part of Chemical Construction in the early 30's.

Natural gas goes through a number of steps before synthesis—in a catalytic reformer it reacts with steam to produce hydrogen and oxides of carbon; air is added as a source of nitrogen; CO reacts with steam to form CO_2 and H_2; CO_2 and CO are removed by scrubbing with absorbents. Then catalytic synthesis to ammonia.

This is the basic outline of the process. But over the last 20 years much in the way of process development has taken place. All the latest improvements have gone into the Phillips plant.

Here are some of the important features:

• Reformer furnace. A new primary reformer permits reforming under pressure. By maintaining part of the initial pressure of the natural gas, the design cuts down on required power for compression.

• Large, efficient, ammonia converters. The Phillips plant consists of three separate trains—each of 150 T/D capacity. The converters are rated at 150 T/D and they are believed to be the largest capacity converters in operation today.

• Truly continuous, straight line flow. This eliminates bulky—and expensive—hold-up equipment. Also, it allows for easy expansion.

• A heat balanced process—the plant makes full use of waste heat and waste gases. Open-air construction also is used where possible.

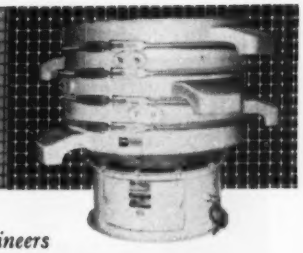
None of these improvements are revolutionary in themselves. But taken together, they all make a big contribution to the all important business of reducing costs.

▶ **Reformer Furnace**—Catalyst containing tubes are suspended in the furnace so that they are free to expand at one end. They are not subjected to temperature stresses as much as in older designs.

This permits the furnace to operate under pressure (at 1,150 deg. F.)—taking advantage of some of the available pressure of the natural gas. The gas coming out of the reformer section is at 15-20 psig. The result? A saving in compressor horsepower of 20 to 25 percent.

▶ **Converter**—The Chemico converter for making ammonia uses an internal heat exchanger and a highly active iron oxide catalyst. Cold incoming gases flow down along the converter wall—cooling the wall to a temperature that permits the use of carbon steel.

SCREENING NEWS



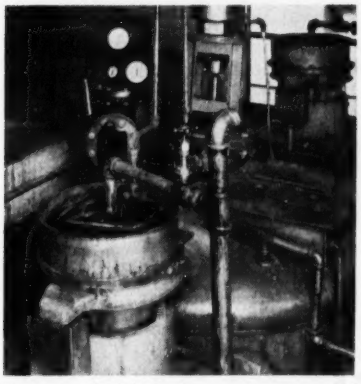
Helpful information on screening and separating operations . . . from field reports of
SWECO SEPARATOR *District Engineers*

Root particles extracted from solvent @ 100 GPH

High efficiency separation of ground Veratrum Viride root particles from an organic solvent solution is accomplished by Riker Laboratories, Los Angeles, on two 18" diameter SWECO Separators at a rate of 100 GPH. They are equipped with 200-mesh stainless steel wire cloth, with .0029 opening.

Screens are mounted on tension rings using leather instead of neoprene mounting . . . typical of the many special screen specifications developed by SWECO to suit the chemical or physical characteristics of the material being screened.

Riker filters and concentrates the minus 200-mesh mixture, then vacuum-dries it to obtain the powdered "Veriloid."



Pharmaceutical laboratory separates ground root extract from organic solvent through 200-mesh cloth with two SWECO vibrating screen separators.

Barium Nitrate, efficiency 99.9%

A Phillipsburg, N.J., chemical firm is using three 48" SWECOS to screen a total of 1350 to 1500 lbs. per hr. of barium nitrate through 100-mesh cloth, to government specifications allowing only 1/10 of 1% oversize.

Paint impurities "discovered," quality control improved

A prominent paint manufacturer installed a SWECO vibrating screen separator to remove small splinters after storage of paint in wooden tanks. Using a 200-mesh screen, they discovered not only splinters, but unground pigment, granules and other impurities. Blinding eliminated conventional rectangular screens. Result: SWECO Separator installed for improved quality-control.

Heavy barite ore screened through 10-mesh at 10 TPH

Barium Products, Ltd., Modesto, Calif., screens barite ore weighing approximately 180 pounds per cubic foot on a two-deck 48" SWECO, obtaining 10 TPH of the desired product (minus-10-mesh). They use a 6-mesh and a 10-mesh cloth.

Motor-weight adjustment solves coke screening

Adjustment for maximum turbulence, by using heavy (9-inch) top motor weight, enables the SWECO to screen coke for Tennessee producer through 4, 6 and 8-mesh screens—with no blinding. Material weighs 45 lbs. per cu. ft., contains 20% moisture. Tests on conventional vibrating screens resulted in blinding.

10 times greater capacity in competitive tests

An Illinois chemical firm, already using SWECOS in chemical processing, conducted competitive tests with the circular-vibratory SWECO Separator against rectangular "downhill shakers" on 10 different powders through 46-mesh and 74-mesh screens. SWECOS averaged 10 times the capacity per square foot of screen area compared with conventional screens.

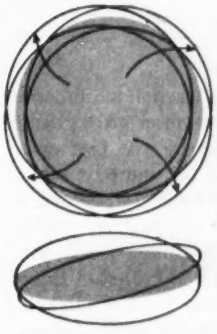
1000 GPH of Coney Glue screened through 230-mesh

Glue of 4 to 9 Baumé, heated to 130-degrees Fahrenheit, is fed to a 48" diameter SWECO vibrating screen at 1000 GPH to remove small hair, fibres, etc. Customer estimates this is about ½ actual capacity. Tests run on heavier glue, 20 to 30 Baumé, showed satisfactory results at feed rates of: 1200 to 1400 GPH for 94-mesh cloth; 900 to 1000 GPH for 145-mesh cloth.

Tests on sodium peroxide

Satisfactory results are reported on screening tests of sodium peroxide, using 20-mesh and 50-mesh screens on a 2-deck 18" diameter SWECO. Volumes handled varied between 800 and 1900 lbs. per hr. at various settings and rates of feed. The material was dry and hot (200 to 300 degrees F). It is estimated that capacity on a 48"-diameter SWECO unit would be about 7,000 lbs. per hr. maximum.

New "3-D" screening action



The unique "spiral-gyratory" action of the SWECO floating-screen Separator tumbles the material in all three directions at once . . . results in faster, more efficient separation . . . reduces blinding and clogging.

Free screening analysis and recommendations . . . SWECO District Engineers are available to make detailed analyses and recommendations on specialized screening operations without cost to you.

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SWECO PRODUCTS:
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Custom fabrication of all types of steel and special alloy vessels for the process industries.

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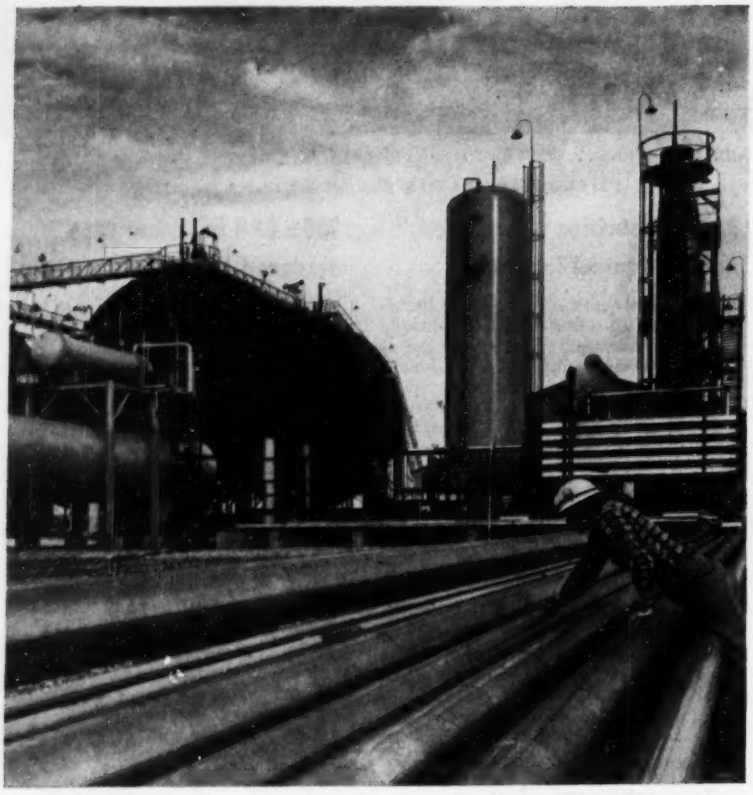
☐ Send data on water-pollution ☐ Have SWECO representative call

Name

Firm

Address



END OF THE LINE—liquid ammonia is delivered to storage and loading area.

The ammonia reaction is exothermic—a great heat evolution takes place in the catalyst. But for the best operation the catalyst bed must be kept at a uniform temperature of 500 deg. C.

This is accomplished by putting cooling tubes in the catalyst bed.* Incoming gas is first heated in the exchanger and then flows through the cooling tubes—in the same direction as the gas passing over the catalyst. By the proper distribution of these cooling tubes, the catalyst temperature of 500 deg. C. is held constant throughout the bed.

▶ **Other Features**—You won't see any hold-up gas tanks at the Phillips plant. Continuous flow has eliminated all such expensive equipment. And in line with modern, continuous plants—this one is highly instrumentized.

▶ **The Process**—Natural gas is brought in by pipeline from the reserves of the Chocolate Bayou field, some 40 miles away.

*Other designs use layers of catalyst—with means of cooling between layers. This point-by-point temperature control is used in the M. W. Kellogg and Fauser-Montecatini converter designs.

It's passed through a sulfur removal vessel and then combined with steam. Reaction between the gas and steam takes place in the tubes of the primary reformer furnace. Nickel catalyst in the tubes promotes a reaction which results in a gas composed of CO_2, CO, hydrogen and some methane. Combustion of natural gas around the tubes keeps the temperature at 1,150 to 1,200 deg. F.

Injected air, as a source of nitrogen, mixes with the gases coming out of the primary reformer. This is then passed through a secondary reformer where residual methane is converted.

Steam is added to the gas out of the secondary reformer and the combination goes into a CO reactor. Iron oxide catalyst promotes the water-gas reaction; where CO and steam form CO_2 and hydrogen. Also the outlet from the CO conversion has the theoretical $3H_2$:N_2. Pressure at the end of the reform section—20 psig.

▶ **Purification**—Now all oxygen-containing compounds must be removed. They poison the converter catalyst.

First CO_2 is absorbed in an aqueous solution of monoethanolamine (MEA). This is all done before any compression of the gas.

Four stage compression (2,200 hp. gas engine driven reciprocating compressors) takes the gas up to 1,800 to 2,000 psig. Scrubbing with an ammoniacal cuprous formate solution removes oxygen, CO and CO_2. The MEA and formate solutions are regenerated and recycled.

Final compression brings the purified gas to 5,200 psig. In an oil filter recycle gas from the converter, mixes with the synthesis gas. The recycle material contains H_2, N_2 and some NH_3.

▶ **Synthesis**—Precooling comes next, in a cold exchanger. Then condensation in an ammonia cooled condenser. Condensation brings out residual ammonia and the last traces of CO_2 and water vapor. This is important, because it insures prolonged catalyst life.

A pass through the cold exchanger brings the synthesis gas to 30 deg. C. It is now ready for synthesis.

Entering at the upper part of the converter, it flows down along the high pressure converter wall. Preheating takes place in the internal heat exchanger. The gas then passes through the internal cooling tubes and into the catalyst bed.

At 5,200 psig., promoted by an iron oxide catalyst, 1 part of nitrogen and 3 parts of hydrogen combine to form ammonia.

▶ **Recirculation**—About 25 percent conversion to ammonia is achieved. The exit gases go through a water cooled condenser where ammonia liquefies.

Uncondensed gases go to the circulating system to be mixed with fresh synthesis gas.

Liquid, anhydrous ammonia goes to storage. It's held at 50 psi. in any of four 1,000-ton Hortonspheres.

Where is all this ammonia going? Some is destined for agricultural fertilizers. Phillips has just completed additions to its ammonium sulfate plant at Adams Terminal. Some will move in its original state to consumers for that increasing use—direct injection of ammonia into the soil.

Phillips will use ammonia in the pyridine plant at Adams Terminal. Nitric acid manufacturers and other industrial users will also have call on the ammonia output.

"You see POWELL VALVES everywhere!"

And no wonder! For The William Powell Company makes more kinds of valves and has probably solved more valve problems than any other organization in the world.

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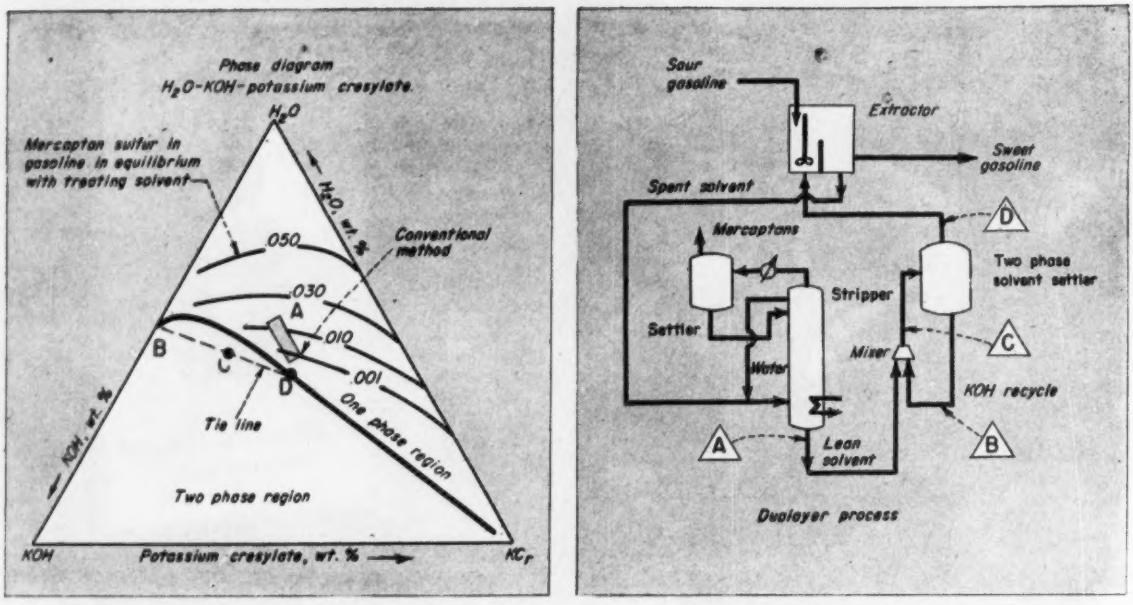
108th year



If working with three component solvents, a new method might. . . .

Improve Your Liquid-Liquid Extraction

New Dualayer extraction process improves on older methods, by delivering a controlled, optimum solvent for extracting mercaptans from gasoline.

Many liquid-liquid extraction processes–particularly for gasoline refining–use three component solvents. Magnolia Petroleum Co. engineers–dissatisfied with conventional methods using such solvents–have come up with a clever process which gets more effective use out of a three component extraction solvent.

The new Dualayer process–worked out for extracting mercaptans from gasoline–takes advantage of the fact that extractive power of the mercaptan solvent increases as the composition approaches the two-phase solvent region (see triangular diagram).

Rather than avoid the two-phase formation–as conventional methods do–the Dualayer process brings the lean solvent over into the two-phase region; separates the two layers and uses the top layer for mercaptan extraction. The result is a big improvement over conventional methods:

- More complete removal of mercaptans from gasoline, based on the same number of extraction stages.*
- Smaller equipment because of lower solvent-feed ratios.
- Simpler control of solvent composition.

▶ **Process Improvement**–For mercaptan removal "sour" gasoline is fed into an extractor and brought into contact with the three component solvent. This is usually potassium hydroxide, water and an organic acid–the acid acting as a solubility promoter.

Spent solvent, or extract, goes into a stripper column–where mercaptans are taken off overhead.

In the conventional methods, the lean solvent coming out of the bottom of the stripper, recycles back to the extractor. But in the Dualayer process, KOH solution is added to this lean solvent, bringing it over into the two-phase region. It's then separated in a settler and the top layer used to extract mercaptans from gasoline.

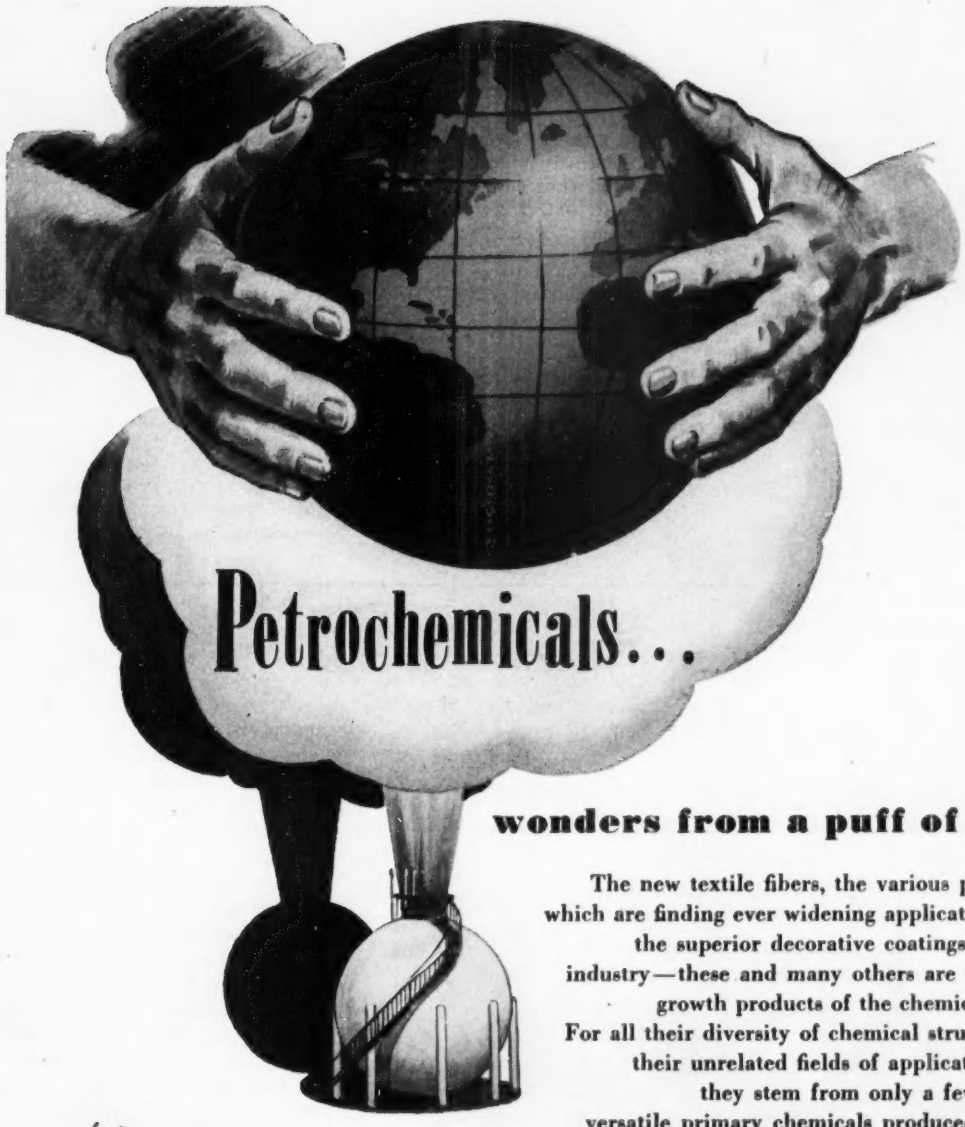
▶ **Two Phases**–Why two phases? The advantages show up clearly on the three component phase diagram.

In gasoline practice the three solvent components would be potassium hydroxide, water and potassium cresylate. KOH is used in preference to NaOH because the KOH solutions are less viscous. Cresylic acid is picked up by the caustic–no outside source is normally required.

Plotting the equilibrium conditions of mercaptans with the solvent shows up some interesting trends:

1. Extraction power for mercaptans increases as the solvent composition approaches the two phase region.
2. It also improves the closer the composition gets to the potassium cresylate apex of the diagram.
3. Viscosity increases as the compo-

* Mercaptans are removed from gasoline because they decrease its octane number.



Petrochemicals...

wonders from a puff of gas

The new textile fibers, the various plastics which are finding ever widening applications, the superior decorative coatings of the paint industry—these and many others are the growth products of the chemical industry. For all their diversity of chemical structure and their unrelated fields of application, they stem from only a few simple but versatile primary chemicals produced from petroleum gases which we call petrochemicals. At Tuscola, Illinois, National Petro-Chemicals Corporation is now manufacturing such petrochemicals, in particular ethyl alcohol and ethyl chloride. A polyethylene plant will begin operations in 1955. If you need petrochemical building blocks in your production, why not consult with us regarding your raw material requirements.

NATIONAL PETRO-CHEMICALS

CORPORATION

A joint enterprise of National Distillers Products Corporation and Panhandle Eastern Pipeline Company

120 BROADWAY, NEW YORK 5, N. Y.

sition approaches the potassium cresylate apex. This is a limiting factor, since good separation in the extractor is obtained with low viscosity treating solvents.

The reason conventional extraction methods never satisfactorily remove mercaptans is because the one-phase solvent reaches equilibrium with the mercaptans in gasoline, before substantial removal.

For example, an extraction solvent (A) far from the two phase region—25 percent KCr, 55 percent H_2O and 20 percent KOH—is in equilibrium with 0.01 percent mercaptan sulfur. (See diagram on page 144.)

But if a KOH solution is added to that solvent composition, bringing it over into the two phase region (B)—25 percent KCr, 40 percent H_2O and 35 percent KOH—less than 0.001 percent mercaptan sulfur will be in equilibrium with the top layer.

▶ **Dualayer Process**—Gasoline distillate (containing mercaptans) enters a mixer-settler extractor. Here it comes into contact with the KCr treating solvent.

After separating out the "sweet" gasoline, spent treating solution is diluted with an equal volume of water. It's then sent to regeneration tower equipped with closed steam coils.

▶ **Stripping**—Water is converted to stripping steam in the tower. It's removed as a liquid on the water separation tray in the upper portion of the column and used for diluting the spent solution.

Vapors from the column are condensed. Mercaptans are removed from the condensate. The water layer refluxes back to the column.

Lean treating solution comes off the bottom of the tower. It is blended with 50 deg. Be KOH solution and fed to the Dualayer equilibrium drum.

Here the two layers separate. The bottom layer of KOH and water is recycled—and mixing with the lean treating solution.

The top layer goes to the extractor.

Actually, the entire process is controlled at two points:

1. Water content of the treating solution. By the stripper temperature.
2. Potassium hydroxide content. By the two phase equilibrium.

There is no doubt that the process works. Here is proof on a west Texas gasoline.

	Treating solution		
	Dualayer	Solutizer (One Layer)	
Solution to gasoline ratio, volume	0.02	0.20	0.40
Mercaptan removal, percent			
1 stage	91	71	84
2 stages	100	80	93
3 or more	100	93	96

Convention Calendar

American Institute of Chemical Engineers, Philadelphia-Wilmington Section all-day meeting on "Distillation in Practice," University of Pennsylvania Museum, Philadelphia, April 27.

The Electrochemical Society, 105th meeting, LaSalle Hotel, Chicago, May 2-6.

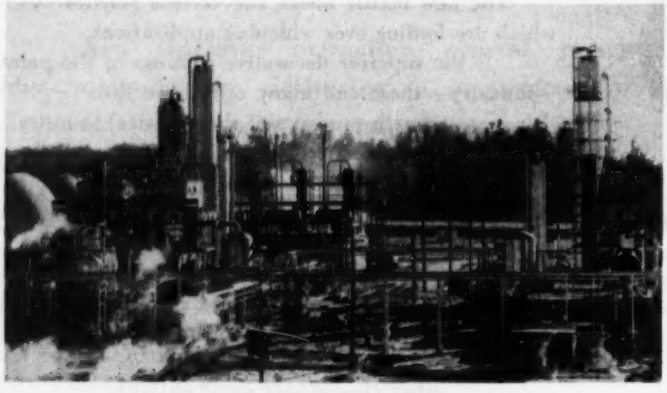
Air Pollution Control Association, annual meeting, Patton Hotel, Chattanooga, Tenn., May 3-5.

American Institute of Chemical Engineers, New Jersey Section all-day symposia on "Mixing and Blending," "New Techniques in Chemical Engineering" and "The Engineer and Human Relations," Hotel Essex House, Newark, N. J., May 11.

Chemical Market Research Assn., current business conditions in rubber, petrochemicals, synthetic fibers and plastics, Statler Hotel, New York, May 20.

Chemical Specialists Manufacturers Association, mid-year meeting, Netherlands Plaza Hotel, Cincinnati, May 23-25.

American Society for Testing Materials, annual meeting of Committee on Mass Spectrometry, Jung Hotel, New Orleans, May 24-28.



New Gas Reformer Adds Ammonia Capacity

Completion of new gas reforming facilities (right) has upped Mississippi Chemical Corp.'s ammonia capacity from 120 to 180 tons per day. A single stage reformer—15 psig. outlet pressure—is followed by CO conversion and MEA scrubbing for CO_2 removal. The gas is then compressed to 1,000 atmospheres prior to high pressure methanation and ammonia synthesis via the Claude process. The company is also planning a low pressure methanation unit to remove all carbon monoxide prior to compression. This will be followed by additional reforming and compression units to bring Mississippi Chemical's total ammonia capacity to about 290 tons per day.

For more WHAT'S HAPPENING . . . Page 374

NOW

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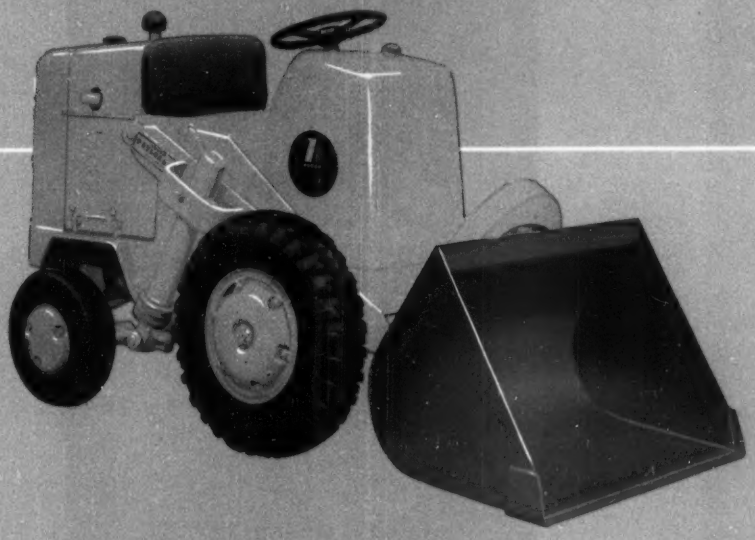
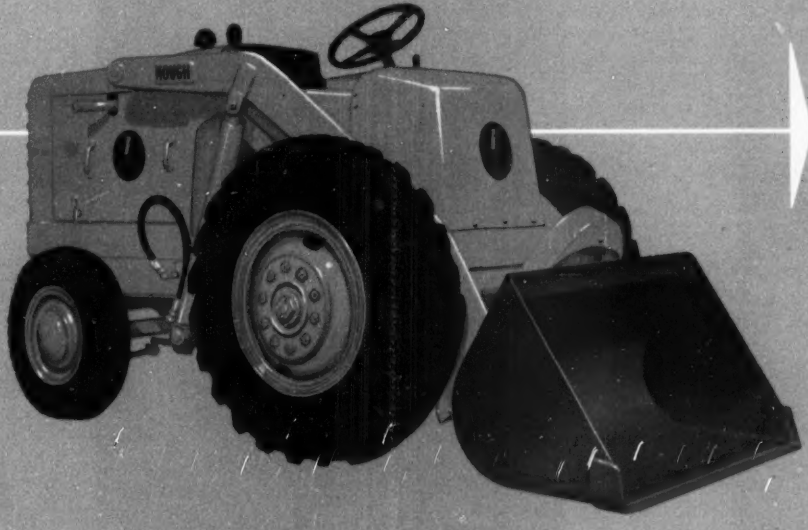


NEW..

TORQUE CONVERTER DRIVE ON MODEL HA

12 CU. FT. CAPACITY (STRUCK-LOAD)
16 CU. FT. CAPACITY (PAYLOAD)



NEW..

TORQUE CONVERTER DRIVE ON MODEL HAH WITH POWER STEERING

18 CU. FT. CAPACITY (STRUCK-LOAD)
24 CU. FT. CAPACITY (PAYLOAD)

Greater Output · Easier Handling · Lower Upkeep

Details on other side

NEW Torque Converter Drive Multiplies PAYLOADER® Output

FASTER OPERATION

Torque Converter *automatically* selects highest operating speed in relation to the load.

INFINITE SPEEDS

4-speed transmission, plus Torque Converter, provides an infinite number of operating speeds.

EASIER OPERATION

Torque Converter, by multiplying torque without changing gears, simplifies operators work.

PRECISE CONTROL

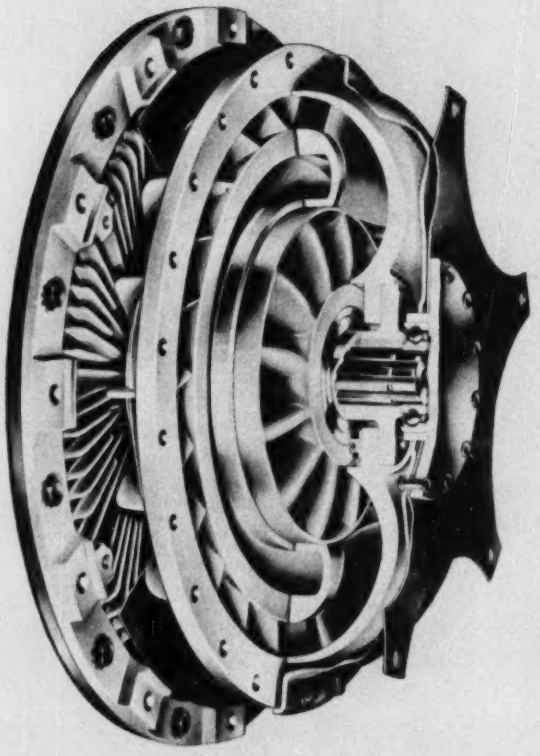
"Pinpoint" control for close maneuvering by accelerator only. Clutch slipping is eliminated.

FULL ENGINE POWER

Engine operates at most efficient speed. Eliminates stalling and delays waiting for power pick-up.

LOWER MAINTENANCE

Cushion of oil absorbs load shocks prolongs life of entire drive assembly. Less down-time results.



Heavy duty, precision-built combination torque converter—fluid coupling multiplies torque up to 2.1 times for starts and heavy loads...it is an efficient fluid coupling when loads are light.

WRITE for information regarding these new models, or any of the front-wheel, rear-wheel or four-wheel-drive models. Payload (heaped) capacities from ½ to 2 cubic yards.

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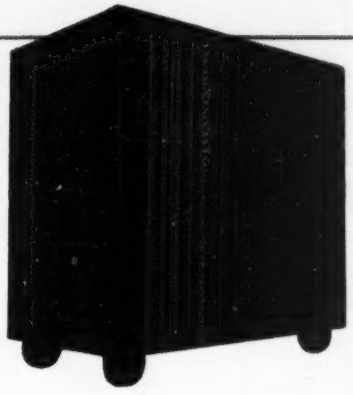
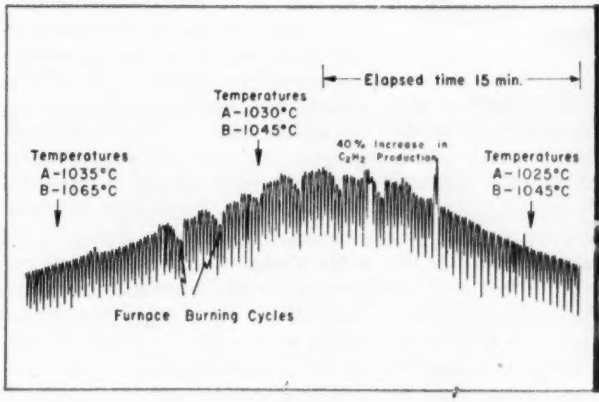
New acetylene production process uses the

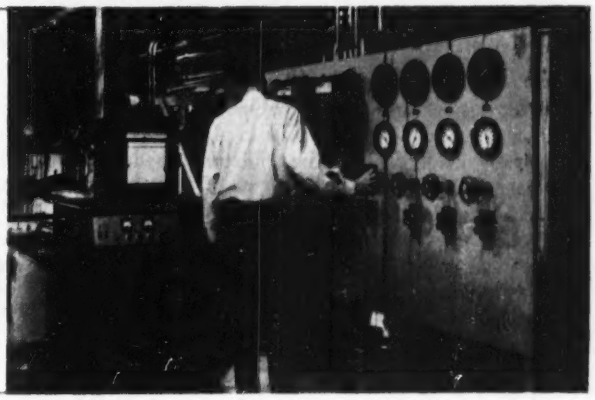
Consolidated continuous process–monitoring mass spectrometer..... for "on the spot" control

The new Consolidated Model 21-610 continuous process monitoring mass spectrometer played a part in the development of the Wulff Process for the commercial production of acetylene. Requiring only 110 volts and a small quantity of cooling water for operation, this self-contained, completely portable instrument was placed on stream in the pilot plant, where it monitored various gas streams under a variety of imposed conditions. Samples from 19 different points, introduced through a common manifold for analysis, made possible among other things: (1) the monitoring of feed stock, (2) evaluation of cracking gas composition versus temperature, (3) determination of fuel gas composition, (4) measurement of acetylene or ethylene content in recycle gas, (5) diacetylene scrubber efficiency, (6) acetylene or ethylene absorber efficiency, (7) solvent recovery and/or loss, (8) final product purity.



The chart, below, left, illustrates the versatility and practical value of the Model 21-610 as a production control instrument. The mass-26 peak of acetylene was monitored in the cracking gas coming directly from the unit as the furnace temperature was varied. From right to left, the temperature was slowly increased. The rise in the cyclically scanned 26 peak indicates rising acetylene content of feed stock. This test showed that acetylene increased approximately 40% with a temperature rise of 5 degrees C. Using the chart as a reference, guesswork was eliminated and maximum future production assured. Write for Bulletin CEC-1824-X18.





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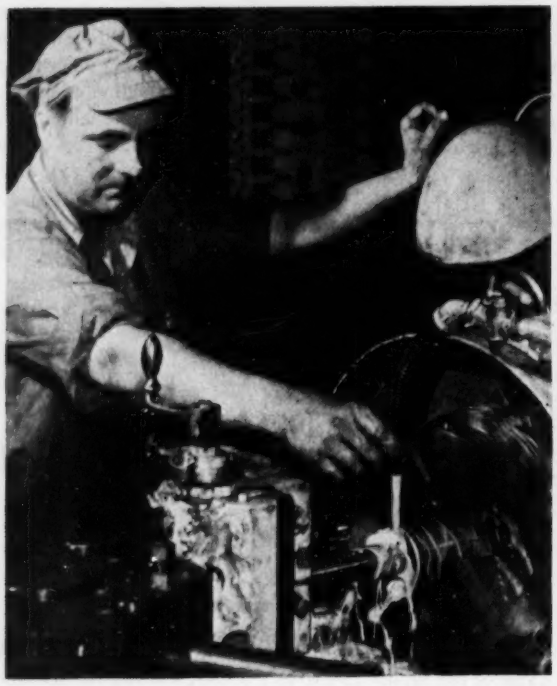

AS LUBRICANTS . . .

AND DEFOAMERS . . .

Polypropylene Glycols Are Growing Fast

Compatible with oils and resins, these surface-active, noncorrosive polyglycols are finding plenty of uses. Sales are now running several million pounds a year.

Take some propylene glycol, add a dash of catalyst, heat and pour in propylene oxide until the mixture thickens. Strain and serve.

This is what happens, in cookbook jargon, when polypropylene glycols are made commercially. Being a little more specific, propylene oxide is reacted with propylene glycol under closely controlled conditions of temperature and pressure in the presence of an acid or alkaline catalyst. The propylene oxide is added until the desired viscosity is reached. The reaction mixture is neutralized, devolatilized and filtered to yield polypropylene glycol of almost any molecular weight.

▶ **Good Solubility**—Polypropylene glycols are soluble in many substances: hydrocarbons, phthalic acid plasticizers, chlorinated solvents, alcohols and ketones. They are also compatible with oils, resins and waxes.

Solubility in water is dependent on molecular weight—as the length of the chain increases the aqueous solubility decreases. A polymer with a molecular weight of 400 is completely miscible while one with a molecular weight of 2,000 is substantially insoluble.

Another characteristic of these compounds is their inverse water solubility. Apparently they dissolve by hydration, are less soluble as temperature rises.

▶ **Technical Notes**—PPG's show good viscosity-temperature relationships, high flash points and low pour points. Low volatilities and low hygroscopicities round out the physical properties.

Chemically speaking, the PPG's esterify likes secondary alcohols by virtue of their terminal hydroxyl groups. Also, all the polypropylene glycols are more oil and hydrocarbon soluble and less hygroscopic than the comparable polyethylene glycols.

▶ **No Sludge**—Currently the least expensive of the synthetic lubricants available in commercial quantities, PPG's were originally offered for use in hydraulic brake fluids. Castor oil had been used for many years because it will not swell rubber.

But the polyglycols found ready acceptance as replacements for castor oil because they exhibit superior viscosity-temperature relationships and

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Products on these pages this month made news . . .

Page Number is also Reader Service code number

Polypropylene glycols are growing fast 150A
Modified fatty acids 152A
Vinyl copolymers with built-in plasticizer 154A
Silicone rubber vulcanizes easily 154B
Corrosion-proof bond 154C
Insulation epoxy resin 154D
Calcium lignosulfonate 156A
Moldable plastic foam 156B
More coal chemicals 158A
Cleaner for metals 158B
Epoxy plasticizer for vinyls 158C
Concrete flooring process 160A
Weed killer 160B
Butylene oxide isomers 160C
Two plasticizers for vinyls 160D
Sodium lauryl sulfate needles 160E
Lubricant-cleaner for metals 160F
Nonbrittle cement for nylon 160G
Isocyante foamed in place 160H

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do not form sludges when oxidized. Sludge formation is prevented because oxidation products are either volatilized or are soluble.

PPG's show promise in other lubricant applications because of their negligible corrosive effect on metals. The lower molecular weight polymers —in the 400 range—are sufficiently water soluble to serve as metal working lubes in aqueous solution. Effectiveness here is attributed to the products' inverse water solubility—they drop out of solution at the point where the most heat is generated.

Major limitation of the polypropylene glycols as lubricants is that they cannot be maintained at temperatures above 350 deg. F. in the presence of air without undergoing weight loss, even when antioxidants are present.

▶ **Many More Uses**—The versatile solvent characteristics of PPG's allow their use in ink and lacquer formulations. Polyglycol P1200* finds application as an antifoam agent in the paint, ceramics, paper and chemical process industries. Large quantities of Polyglycol P2000 are consumed in the preparation of petroleum demulsifiers.

As chemical intermediates, PPG's react with fatty acids to form nonionic surface active esters; with dibasic acids they yield alkyd resins. Their dinitrate esters increase the cetane number of diesel fuels; their ethers serve as lubricants and hydraulic fluids.

* Dow Chemical's PPG's are designated by the letter "P" followed by a number indicating the average molecular weight.

Studies indicate that some of the higher polymers, particularly P2000, may also be suitable for use in cosmetic formulations involving appreciable ingestion or extensive and prolonged skin contact. This is not true of the lower members of the series, however, because of their undesirable toxicological properties.

▶ **Seven Years Developing**—The Dow Chemical Co. initiated development work on the polypropylene glycols in 1947. It stemmed from a desire to diversify uses for propylene oxide by investigating the properties and applications of its polymers. The organo-solubilizing and pour-point-reducing effect of propylene oxide polymerization were felt to be unique enough to warrant exploitation.

Only Polyglycol P750 was made that first year, but by 1949, Polyglycols P400, P1200, and P2000 were in semi-commercial production. The first tank car shipment came in 1950 and all of the products were in volume production by 1952. An offering was made in 1953 of Polyglycols P250, P3000, and P4000. (These products are not yet commercially available.)

Dow polyglycols of the "P" series are similar to those manufactured by Carbide and Carbon Chemicals Co. PPG's are often interchanged with polypropylene glycol monoethers and mixed alkylene oxide polymers sold under the trade names of Polyglycol 15 (Dow) or Ucon Fluid (Carbide & Carbon). **150A**

Modified Fatty Acids

Are unlike any other fatty acids now commercially available.

Makers of soaps, cosmetics, alcohols, greases and textile softeners can all benefit from using three new, low-cost, modified fatty acids, which are now being made by Emery Industries. The unusual thing about these products is that while they have the color and heat stability normally associated with palmitic and stearic acids, they have the consistency and solubility characteristics of distilled tallow fatty acids.

For example, the acids do not materially darken when heated in air for two hours at 205 deg. C. Yet their potassium soaps are liquid at concentrations over 16 percent in water at 70 deg. F. Potassium soaps of comparable hydrogenated tallow or stearic acids aren't soluble at 70 deg. F. even at concentrations as low as one percent.

Two of the acids, F-995-R and F-996-R are essentially saturated C_{18} and C_{18} monocarboxylic acids—iodine values of 4 and 2, respectively. The third, F-994-R, has a polyunsaturated acid content of 0.5 percent and an iodine value of 34.5. All are shipped in aluminum tankcars or lacquer-lined 55-gal. drums.

In hydrocarbon systems, the aluminum soaps of these acids are said to possess outstanding gelling properties. Worked stability of such alu-

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The Heyden products listed here have long been recognized for their high purity and uniformity by production and research men in the drug, pharmaceutical and process industries. One of these chemicals may be the intermediate you need to give your product better quality and sales appeal. Samples and further information are available upon request.

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Chemical Progress Week May 17-22

minum greases is comparable to that of commercial high-gel stearates and much superior to those made with soaps of stearic or fish fatty acids.

Other expected uses are as raw materials for liquid, paste and bar soaps, soaps used to polymerize synthetic rubber, cosmetics (such as shaving creams), fatty alcohols and textile softeners.—**Emery Industries, Cincinnati 2, Ohio.** **152A**

Vinyl Copolymers

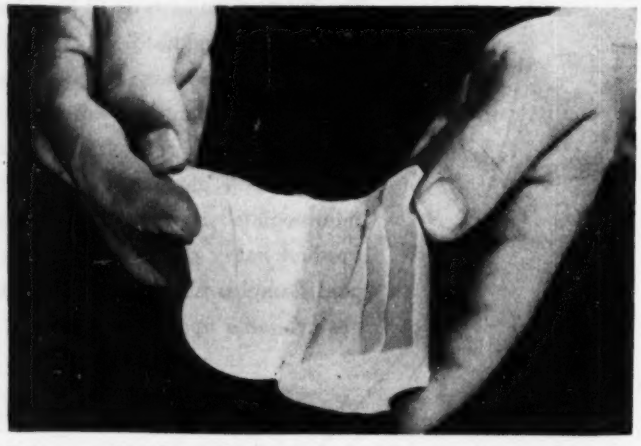
Products have "built-in" plasticizer that controls elasticity.

Vinyl stearate, produced from inedible animal fats, is the big feature of new vinyl chloride copolymers developed by the U. S. Dept. of Agriculture. Chemically bound in the copolymers, the vinyl stearate acting as the plasticizer cannot migrate or evaporate—hence the term "built-in."

The new copolymers can be either rigid or flexible, depending on the amount of stearate included. The flexible variety (high vinyl stearate content) are similar to combinations of polyvinyl chloride and commercial plasticizers.

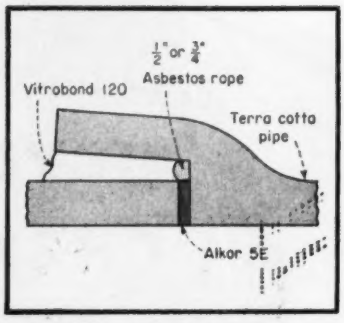
The rigid types have a lower milling temperature and lower bulk viscosity temperature coefficient than commercial vinyl plastics now available. Thus they are easier to handle in such operations as calendering, molding and extrusion because less stringent control of pressure and temperature is required.

Both the flexible and rigid types of the new copolymers can be cured with polyfunctional amines to yield infusible, insoluble resins. Because of their relatively low milling temperatures they can be compounded and preformed at lower temperatures (about 200 deg. F.) and then cured at higher temperatures (about 340 deg. F.) The flexible copolymer retains much of its plasticity after curing.—**U. S. Dept. of Agriculture, Washington, D. C.** **154A**



Silicone Rubber Vulcanizes at Room Temperature

Neither heat, pressure nor full exposure to air is required to cure sections up to ½-in. thick of RTV Silastic, a new silicone rubber. And it develops the high and low temperature stability, water repellency and chemical resistance of silicone rubber within 24 hours after application. Optimum properties develop in 4-7 days. Two components, each containing a catalyst, are shipped and stored. Simple mixing in equal parts by weight yields the rubber. Sample above was mixed in a glass jar, shaken vigorously and cured for 48 hours at room temperature.—Dow Corning Corp., Midland, Mich. **154B**



Corrosion-Proof Bond

Cement combination gives chemically resistant pipe joint.

Vitrified clay pipe joints that resist practically all corrosive agents can now be made easily. First step is to trowel in a narrow ribbon of Alkor 5E chemical resistant cement (see cut). Next you fill the annular space between bell and pipe with Vitrobond 120 bonding cement.

Alkor 5E, based on a polymer of furfuryl alcohol, provides protection against all alkalis, non-oxidizing acids, solvents, greases, salts and detergents at temperatures up to 375 deg. F.

Use of inexpensive Vitrobond 120 to supply most of the bonding action lowers the over-all cost of the joint. And the heat of the molten Vitrobond accelerates the setting of the Alkor cement, permitting the completed joint to be put in service faster. —**Atlas Mineral Products Co., Mertztown, Pa.** **154C**

Insulation Resin

Epoxy resin is usable from three to five days before setting up.

Production line techniques in the electrical manufacturing industry often call for an insulation resin that can be mixed in large quantities for use over a period of days. Most epoxy resins on the market, however, have been usable only an hour or two before hardening.

Now a new epoxy, Scotchcast No. 3, with a utility life of from three to five days before setting up, has been introduced. Combine this advantage with good electrical and physical properties and a short cure life—two to four hours at 250 deg. F.—and

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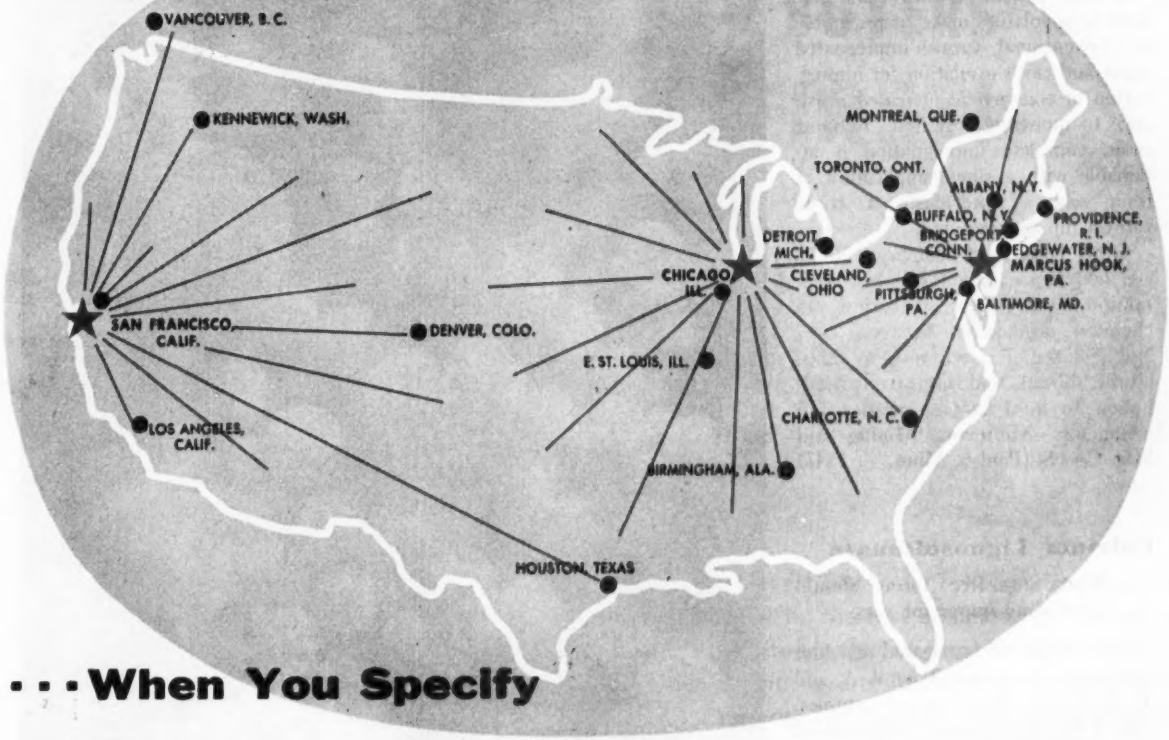

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37-38%, Reagent, A.C.S. (Sp.Gr. 1.18)

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you have a resin with many possible uses.

Scotchcast's low viscosity and freedom from volatiles makes it preferable to conventional varnish-impregnated paper and cloth insulation for impregnation of coils where increased resistance to moisture is desired. In most cases, complete impregnation is attainable with a single application of resin whereas previously a triple varnish dip was required.

Other features of Scotchcast No. 3 are its 100 percent solids nature with minimum shrinkage on curing; no chemical degradation between −65 and 250 deg. F.; resistance to acids, alkalis, solvents and oils; excellent adhesion to most metals, plastics and conductors.–**Minnesota Mining and Mfg. Co., St. Paul 6, Minn. 154D**

Calcium Lignosulfonate

New, sugar-free forms should have many important uses.

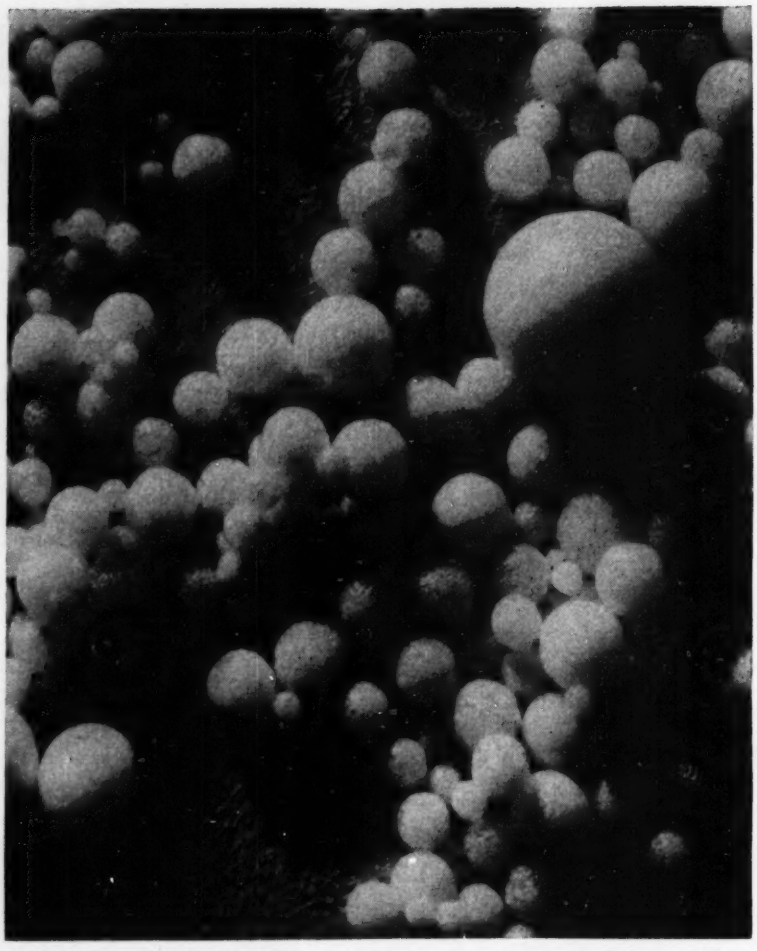
Two types of desugared calcium lignosulfonate–called Toranil A and B–are being offered in test samples. The A type is a viscous, coffee-colored solution with a characteristic tart odor. Type B is a free-flowing, light tan powder. Both are completely water soluble, yet virtually nonhygroscopic.

In the production of high grade softwood pulp, the nonfibrous portion of the wood is extracted with calcium bisulfite. In producing the Toranils, the crude extract is subjected to a biological process that removes practically all sulfur dioxide and sugar.

This development should greatly increase the possible applications of the compound. Present uses include: dispersing agents for fertilizers and oil well drilling muds, adhesives, resin extenders, cement additives, foam stabilizers and emulsifiers.–**Lake States Yeast Corp., Rhinelander, Wis. 156A**

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.



FREELY-EXPANDED BEADS look like this, but any form is possible via molding.

Now, Moldable Plastic Foam

Picture a kernel of popcorn–how it expands when heated. Now visualize tiny beads of polystyrene plastic heated in a mold and ballooning as much as eighteen times by volume to yield a shaped, foamy structure of individually distinct cells.

Moisture within the popcorn kernel does the puffing; a special foaming agent built into the plastic reacts similarly to heat to transform Koppers new expandable polystyrene beads into polystyrene foam.

Properties like moldability, controlled density, low thermal conductivity and high strength-to-weight ratio make this unusual plastic seem tailor-made for some commercial applications.

▶ **Broad Utility**–Actually, moldability and controlled density give the Koppers product advantages irrespective of its specific end use. For here is a foam plastic that's not limited to processing as sheets and blocks but can be expanded in a heated mold to a variety of shapes and sizes in just one operation.

And this ability to expand suggests another virtue: lower shipping costs. The polystyrene can be shipped in concentrated beadlike form (bulk density of 37 lb. per cu. ft.) and "inflated" to the far bulkier foam (bulk

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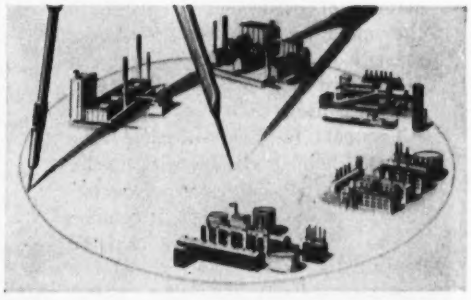

As You Walked Through SOLVAY's Laboratories, you'd no doubt be fascinated by the vast equipment of the largest alkali research facilities in the industry! You'd see SOLVAY's Technical Service with *separate* sections for *different* industries. You'd meet SOLVAY's *industry-wise* consultants who can offer you services not ordinarily available. You'd get first-hand information on how SOLVAY could help you with problems involving the handling, storage and use of SOLVAY products.

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density of 2-10 lb. per cu. ft.) when ready to be used. Put another way, this means that 37 lb. of Koppers plastic beads will occupy only one cubic foot of shipping space rather than the 5-20 cu. ft. which would be required to accomodate the finished foam. Competitive foam-type plastics must, on the other hand, be shipped in their finished forms.

Since the density of a molded piece can be regulated by varying the amount of bead material placed in the mold, a compromise between strength and lightness of weight can be selected that is best suited for a particular use.

▶ **Thermal Insulation**–Because the foam's thermal conductivity, water absorption rate, water vapor permeability and density are low, it qualifies as an excellent thermal insulator. Look at these properties:

- Thermal conductivity: values range from 0.214 to 0.267 Btu./hr./sq. ft./deg. F./in. at 19.9 and 120 deg. F., respectively.
- Water absorption: less than 0.5 percent by volume after immersion for eight days at room temperature, less than 1.5 percent by vol. after 48 hr. under a hydrostatic pressure of 10 ft. of water. And its non-interconnecting cell structure prevents capillary penetration below the surface; pieces dry readily after removal from the water.
- Water vapor transmission: 0.5-1.0 grains of water/hr./sq. ft./in. of thickness/in. Hg vapor pressure difference. Good resistance to water vapor passage minimizes reduction in insulation efficiency caused by condensation in the insulator.
- Density: 2-10 lb. per cu. ft.

Add moldability to these qualities and you have an insulator adaptable for application to the contours of low temperature industrial piping, refrigerator cars and freezer cabinets. High temperature insulating applications are out for the time being, at least, because the material is flammable.

▶ **Many Other Uses**–The low density and good water resistance of polystyrene foam suggest another application: to provide long lasting, high buoyancy in boats, rafts and other marine equipment. Buoyant compartments can be completely filled by expanding the polystyrene beads to the desired shape.

Strength Properties of Koppers Polystyrene Foam*

Density, lb./cu. ft.	2	6	10
Tensile, psi.	30-50	90-110	120-130
Compressive, psi. 5 percent off-set	15-20	60-70	90-110
Flexural, psi.	Flexible	130-160	280-310
Impact in.-lb./in. unnotched	2.0-2.5	3.0-3.5	5.0-5.5

* Values are for foams at 73 deg. F. and will decrease slightly as the temperature approaches the distortion point.

The product is also suitable for panel constructions, because of its mechanical strength at low density (see *table*) and its ability to adhere to itself and other materials–woods, metals, laminated plastics. Helpful, too, are the foam's insulating effect and stability with changes in humidity.

Toys, novelties and displays of unusual and complex forms, normally made by pressing and cutting, can now be shaped by expansion-molding of Koppers polystyrene beads.

▶ **Easy Mechanical Working**–Once formed the new product can be worked–sawed, planed–using either conventional woodworking tools or a resistance wire kept just below red heat (best suited to low density material: 2-4 lb./cu. ft.). Beads in closed containers are stable–retain their ability to expand–at 80 deg. F. for four months; lower temperatures will prolong their life. **156B**

More Coal Chemicals

Hydrogenation derivatives available for research studies.

Coal hydrogenation continues to yield unique aromatic chemicals that can serve as starting materials for organic syntheses. Most recent additions to the growing roster are indole, indanol-4, indanol-5 and a premium grade of naphthalene.

Indole is the basis for synthesizing indole-acetic acid, a plant root hormone, and trytophan, an amino acid. Formerly available only in 50-gram quantities, indol will be offered this spring in 55-gal. drums.

Indanol-4 and indanol-5, two phenols found in substantial amounts in Carbide's high boiling phenols, are obtainable in 50-gram lots for research studies of their possible uses.

The specially purified naphthalene features a melting point above 80 deg. C., negligible sulfur content and a thianaphthene–the unusual impurity –concentration of less than 0.5 percent. Sold now in 5- and 10-lb. quantities, it will soon be put into commercial production, priced at somewhat less than 20c. per lb.–**Carbide and Carbon Chemicals Co., New York 17, N. Y.** **158A**

Metal Treatment

New phosphate cleaner-coater for heavy parts eliminates elaborate cleaning equipment.

Well adapted to metallic industrial equipment too large or too heavy for phosphate treatment by standard procedures, Detrex's new 800 Series of phosphoric acid-type preparations can be applied by brush, sponge, dip and flow-on. The products' functions are two fold: as cleaners they remove rust, light scale, shop dirt and oil; as coating agents they react with ferrous metals to form a fine-grained, crazed surface of iron phosphate into which paint flows and is securely bonded.

Peeling, flaking and corrosive action beneath the paint film–with attendant blistering–are greatly retarded. The large casting shown above has had a 12 month accumulation of rust and dirt removed from the right half.–**Detrex Corp., Detroit 32, Mich.** **158B**

Vinyl Plasticizer

PX-800 Epoxy improves stability, permanence of vinyl compounds.

A new epoxy plasticizer has been developed for use in calendering, extrusion and molding compounds, and in plastisol and organisol formulations.

Called Pittsburgh PX-800 Epoxy, the product offers advantages over ordinary plasticizers in permanence

ALCOA ALUMINAS make these ceramics tougher than steel!
Pump plunger with adapter.
Pump plunger with threaded metal adapter.
Ceramic-lined flow nipple.
Ceramic-lined Christmas tree choke.

Handling untamed acids and abrasive compounds, these parts are breaking all records for economy and long service. Once they were all made of metal. But erosion, corrosion, friction and high temperatures limited their life. Now they're made of high-alumina ceramics.

High-strength ceramics of ALCOA Alumina can be formed to practically any shape, with tolerances of plus or minus .005" or closer. Surfaces can be lapped to any degree of flatness, or given medium high polish or glaze. Moreover, ALCOA Alumina makes ceramics extremely hard . . . highly resistant to corrosion, abrasion and heat . . . high in tensile and compressive strength with a low coefficient of friction.

The same properties which make ALCOA Aluminas ideal for these products may be just what *you're* looking for in *your* product or process. Why not find out? Write today for full information and samples. ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 702-E Alcoa Building, Pittsburgh 19, Pennsylvania.

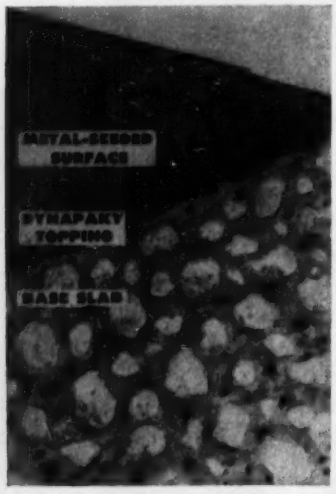
Alcoa does not manufacture ceramics. Illustrated parts manufactured by Coors Porcelain Company, Golden, Colorado.

ALCOA CHEMICALS

ALUMINUM COMPANY OF AMERICA

and volatility. And, because it is of the epoxy type, PX-800 can serve in vinyl compounds as a stabilizer to both heat and light. The amount of metallic stabilizer normally required can therefore be reduced.

Vinyl formulations containing PX-800 exhibit excellent resistance to extraction by oil, gasoline and soap solution. In a properly formulated compound, the plasticizer will remain compatible with vinyl resins after long exposure to light.—**Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. 158C**



Concrete Floor Strength

Iron-chip veneer guards concrete; stops spalling and crumbling.

A new industrial flooring process has been introduced that is said to add the strength of iron to heavily traveled concrete surfaces, such as warehouse, machine shop or shipping floors subjected to rolling and skidded loads.

Named Metal-Seeded Dynapakt, the process features an ½-in. layer of iron-chip aggregate as a non-spalling, non-crumbling, non-slip armor over fresh Dynapakt concrete topping. Special heavy-duty power equipment performs the flooring operation, insures maximum compactness and adhesion of concrete to metal. This intimate interfacial anchorage, it is said, gives floors more permanence than those reinforced by other metal reinforcement methods.—**Flash-Stone Co., Inc., Philadelphia 44, Pa. 160A**

Weed Killer

Is said to equal 2,4-D's power, but is safer to use near cotton.

The recent Southern Weed Conference brought to light several new developments in agricultural chemicals that indicate a trend toward tailor-made formulations that will do one specific job for the farmer. One product that received considerable attention was Dow Chemical's silvex, an entirely new chemical for killing weeds and brush.

Not merely a new formulation of older materials, silvex is chemically, trichlorophenoxypropionic acid. Useful formulations include amine salts and esters, which are applied as a water spray to foliage.

Major advantage over such herbicides as 2,4-D is the fact that cotton shows no harmful effects when silvex is deliberately applied to it at rates substantially above the minimum injurious rate for 2,4-D. This, of course, dictates that most of the current production will be used in cotton areas. But while none of the product will be sold in 1954 for selective use on crops, the company expects to enter this field in the near future.—**Dow Chemical Co., Midland, Mich. 160B**

Butylene Oxide Isomers

Highly-reactive product will extend use of epoxide compounds.

Epoxide chemistry took a big step ahead recently when Dow succeeded in synthesizing straight chain butylene oxide isomers on a commercial scale. This means that epoxide compounds can now be used more advantageously in detergents, emulsifiers, plasticizers, intermediates and hydraulic fluids.

The isomers come as a mixture, containing mostly 1,2-butylene oxide with small amounts of cis and trans-2,3-butylene oxide. It contains less than 1 percent isobutylene oxide.

The new material is readily polymerized to polybutoxy compounds. Also, it can be used alone or combined with ethylene and propylene oxides to synthesize polyglycols—**Dow Chemical Co., Midland, Mich. 160C**

Product Briefs

Two new plasticizers for vinyl compounds, Cabflex ODP (iso-octyl decyl phthalate) and Cabflex ODA (iso-octy-decyl adipate), are priced no higher than octyl esters, yet are less volatile.—**Godfrey L. Cabot, Boston, Mass. 160D**

Sodium lauryl sulfate is now available in the form of small extruded needles. These eliminate the sneezing and sniffing often encounted in plants using a powder form. Also, since it has high bulk density, less storage and kettle space is needed.—**Aceto Chemical Co., Inc., Flushing 54, N. Y. 160E**

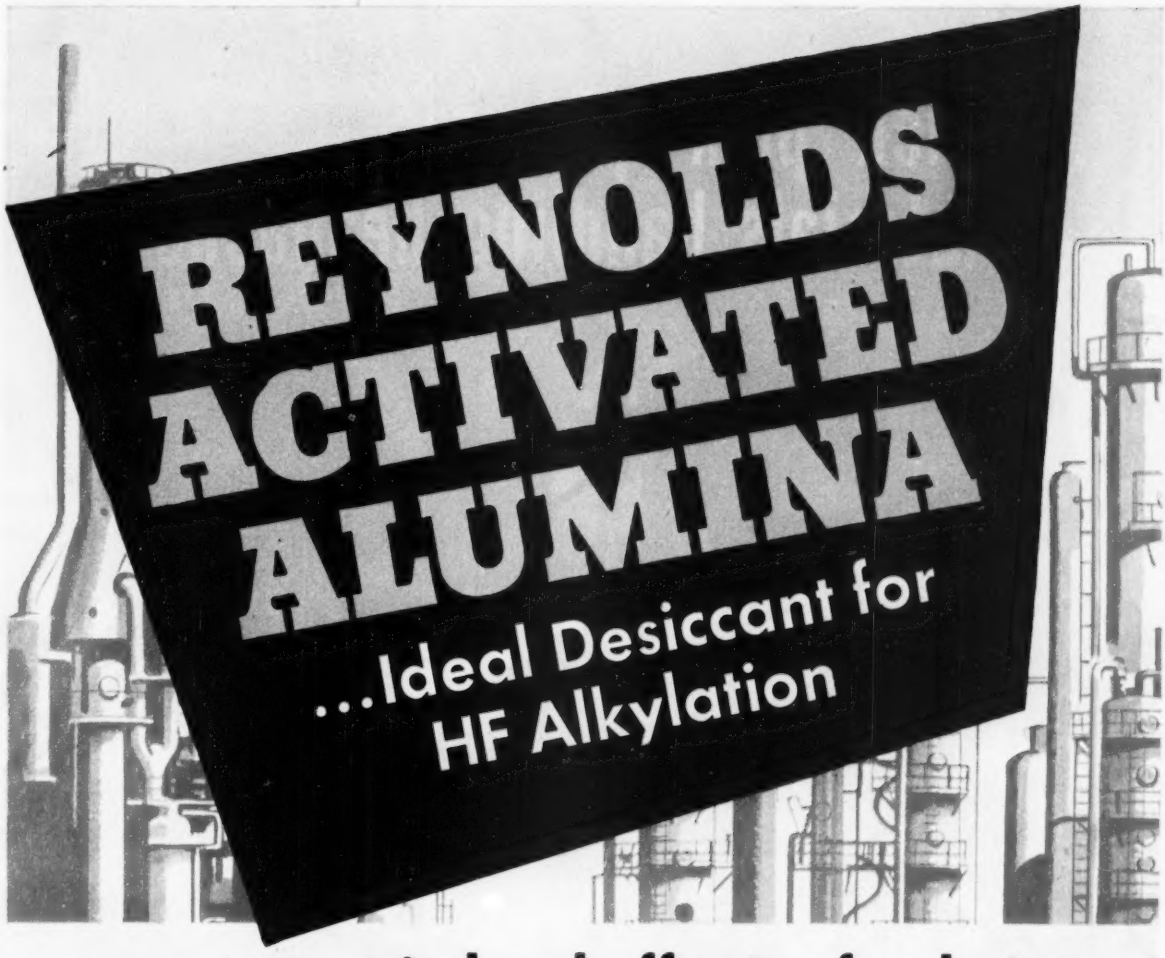
Technilube is a lubricant cleaner that derusts without harming the metal, cleaning and lubricating simultaneously. Its makers claim that the product prevents clogging and sticking of small moving parts.—**Zel-Tex Chemical Co., 425 Bush St., San Francisco, Calif. 160F**

Tough, nonbrittle cement has been designed to bond nylon parts together. Called Nylaweld, it produces essentially invisible joints and can be applied by dipping, brushing, spreading or spraying. There is no degradation under prolonged exposure to boiling water or boiling caustic.—**Polymer Corp. of Pennsylvania, Reading, Pa. 160G**

A foamed-in-place isocyanate foam called Urefoam is now on the market. It's supplied in two components which are mixed to form foams with densities as low as 2 lb./cu.ft.—**Atlas Mineral Products Co., Merztown, Pa. 160H**

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.



more economical and effective for drying many liquids and gases

The specific advantages of Reynolds Activated Alumina for hydrogen fluoride alkylation are:

- **Elimination of silica migration**
- **Better fluoride removal**
- **Dries alkylate while in process**

Basic product advantages include:

- **Non-reactive with process liquids and gases**
- **Easily regenerated**
- **Low initial cost**
- **Withstands liquid water**
- **Low dewpoint**

Prove these advantages in your drying process. Performance will let you compare the absorptive capacity of Reynolds Activated Alumina against the capacity of other desiccants. Write for free brochure on *"Reynolds Aluminum Chemicals"* to Reynolds Metals Company, 2567 South Third Street, Louisville 1, Kentucky.

Put Reynolds Consulting Service To Work For You

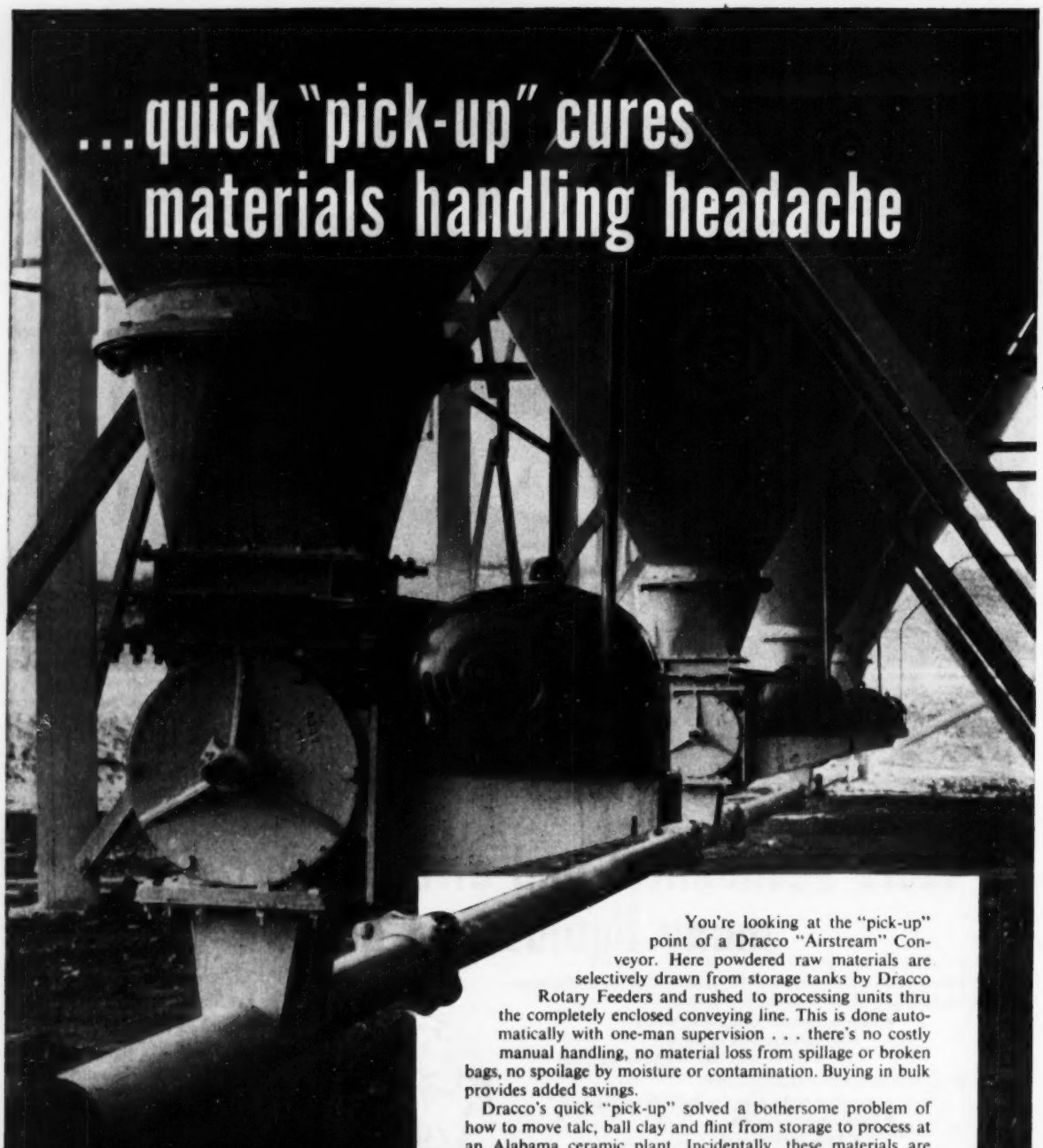
The staff of each Reynolds regional office includes chemical and other engineering specialists to help you save time, money and labor with aluminum chemicals, shipping containers and mill products. When further consultation is desired, there is a fully integrated technical staff at Reynolds headquarters.

See "Mister Peepers" Sundays on NBC-TV. Consult local listings for time and station.

REYNOLDS CHEMICALS

FROM THE PRODUCERS OF REYNOLDS ALUMINUM

...quick "pick-up" cures materials handling headache



You're looking at the "pick-up" point of a Dracco "Airstream" Conveyor. Here powdered raw materials are selectively drawn from storage tanks by Dracco Rotary Feeders and rushed to processing units thru the completely enclosed conveying line. This is done automatically with one-man supervision . . . there's no costly manual handling, no material loss from spillage or broken bags, no spoilage by moisture or contamination. Buying in bulk provides added savings.

Dracco's quick "pick-up" solved a bothersome problem of how to move talc, ball clay and flint from storage to process at an Alabama ceramic plant. Incidentally, these materials are unloaded from railroad cars to storage with similar efficiency by another Dracco "Airstream" system.

It's another example of how to cut handling costs with "Airstream".

Dracco Bulletin 529 presents complete information on handling your bulk materials pneumatically. Write for your copy today.

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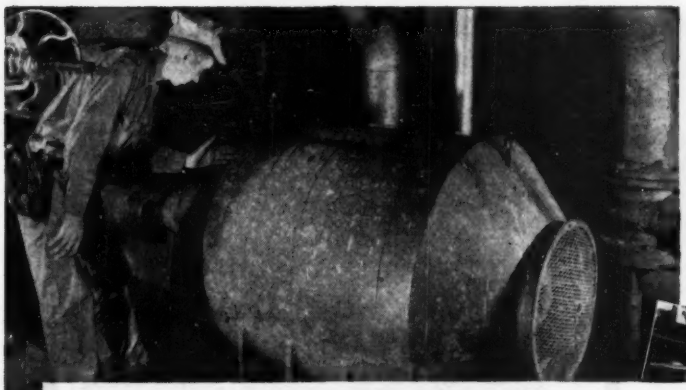
DRACCO *Performance Proved*

Airstream **CONVEYORS • DUST CONTROL EQUIPMENT**



ALLIS-CHALMERS

Totally-Enclosed Fan-Cooled MOTORS

INDOORS or OUT

DIRT and CORROSION

Can't Hurt These Motors

Here is a totally-enclosed type of motor that will solve many of your dirt and corrosion problems. Install anywhere, indoors or out.

Cooling System is Self-cleaning

Cooling air is carried through the heat-exchanger tubes with sufficient velocity to expel practically any kind of dirt. If oily or sticky dirt should cling, tubes can be ramrodded clean in a few minutes because tubes are straight and tube ends are exposed.

Choice of Corrosion-resistant Materials

You can lick corrosion with this motor, too. Tubes are available in a variety of materials to meet practically any corrosive atmospheric condition. Allis-Chalmers tube-type motors have long and successful experience in such difficult applications as caustic plants, refineries and petrochemical plants, power plants with fly ash problems and many others.

Next time you need a motor for a dirty or corrosive location or for outdoor operation in all kinds of weather, call your Allis-Chalmers District Office. Get complete information on Allis-Chalmers tube-type totally-enclosed, fan-cooled and explosion-proof motors. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7149. Available in ratings on frames larger than NEMA 505 up to 3000 hp. A-4222

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

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by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push-button stations and components for complete control systems.

TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

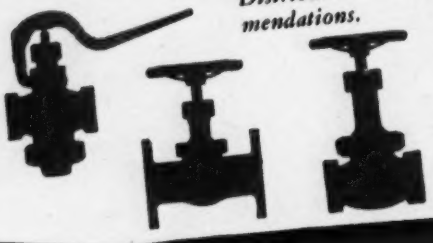
PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

WHAT TO LOOK FOR

when you buy a Bronze Valve

1 LOOK FOR DESIGN. Use the right valve for the right type of service at the right pressure. There is no such thing as an "all-purpose valve" . . . so don't try to make *one* valve do. *In the complete Lunkenheimer line, there are 125 basic bronze valves — each ideal for a certain type of service. Get your Lunkenheimer Distributor's recommendations.*



2 LOOK FOR OPERATING FEATURES, particularly those that make the valve longer-lasting and easier to use, such as the handwheel. *Lunkenheimer patented Non-Slip® Handwheel assures a firm, cool grip—makes it easy to close the valve tight, reducing wear and eliminating leakage. All Lunkenheimer Bronze Valves have the new Non-Slip Handwheel, along with many other exclusive operating features.*

3 LOOK FOR A LONG-WEARING STEM, since stem-thread wear is one of the most common causes of valve failure. *Lunkenheimer Bronze Valves have Stemalloy® Stems — an exclusive silicon-bronze alloy which completely eliminates stem-thread failure. Not one of the millions of Stemalloy Stems now in service has ever been returned because of thread wear.*

4 LOOK FOR CLOSE-GRAINED BRONZE, the mark of valve quality. Dense bronze not only increases the valve's strength, but makes it much more resistant to corrosion. *Lunkenheimer Bronze Valves are made of original Lunkenheimer alloys recognized by metallurgists as the highest-grade valve bronzes ever developed.*

Remember—The Price Of A Lunkenheimer Valve Gets Smaller And Smaller And Smaller With Each Passing Year Of Dependable Service

ALL POPULAR SIZES of Lunkenheimer Bronze Valves are maintained in stock for prompt delivery. Write for new Circulars 534, 582, and 574 describing typical designs. The Lunkenheimer Co., Box 360X, Cincinnati 14, Ohio.

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L-154-15

Save time with quick-dissolving HOOKER SODIUM SULFIDES

get clear solutions in 15 minutes

Your production men can work fast with these Hooker sulfides.

The flakes dissolve in 15 minutes, even without stirring—and in cold water. They give a clear solution, free of sediment—ready for immediate use, with no decanting.

Hooker sodium sulfide is a light buff-colored material in flake or solid form. It contains 60 to 62% Na_2S. Flake form is shipped in lacquer-lined steel drums, 90 and 350 lbs. net. Solid form comes in steel drums, 625 lbs. net.

Hooker sodium tetrasulfide is a dark red aqueous solution containing 40% by weight of Na_2S_4. The solution contains less than 1% sodium thiosulfate, sodium carbonate, and sodium sulfite inclusive. It is shipped in 55-gal. steel drums, 600 lbs. net.

Hooker sodium sulfhydrate, a light lemon-colored solid in flake form, is completely and rapidly soluble in water and alcohol. It is an exceptionally pure material containing 70 to 72% NaSH. It is supplied in lacquer-lined steel drums, 90 and 350 lbs. net.

Before re-ordering your requirements, get the facts on these high-purity sulfides. Just phone the nearest Hooker office listed below. For technical data, mail the coupon today.

Using sulfur compounds? These are only three of a selection of sulfur compounds available in volume. We've specialized in sulfur-chlorine products for more than a quarter of a century; can help you with your requirements for sulfur chlorides and oxychlorides, and organic sulfur compounds as well. If you need a special sulfur-containing compound in quantity, we may be able to produce it economically for you. To find out quickly, just phone the nearest Hooker office or write us today.

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CHEMICAL PROGRESS WEEK—MAY 1954

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From the Salt of the Earth —

HOOKER ELECTROCHEMICAL COMPANY

3-1494

..What will you do with the sludge acid ?

You will load it right back into the tank car, if you are one of a growing number of users of Consolidated Sulphuric Acid who are contracting with us to regenerate their sludge acid.

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640 ESPERSON BLDG. HOUSTON, TEXAS

The answer to most of your questions about stainless steels are right at your finger tips, when you use Crucible's unique new Stainless Steel Selector.

Want to know the machinability characteristics of a stainless grade? Resistance to corrosion or scaling? Physical or mechanical properties? You can get the answers to these and other questions simply by setting the arrow on the Selector slide at the proper window. It's just as quick and easy as that.

And almost as fast as you get the answer, you can get the steel you need. For many of the REZISTAL stainless steels shown on the Selector are carried in stock in Crucible warehouses conveniently located throughout the country.

To get your free copy just fill in and mail the coupon. Better do it now.

HOW THE SELECTOR WORKS:

Start with the problem. For example, resistance to corrosion in contact with copper sulfate. Just set the slide at the proper index number shown on the Selector (in this case on the back), and you have the answer in a second – grades 302 and 316 are fully resistant to this form of attack.

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54 years of Fine steelmaking

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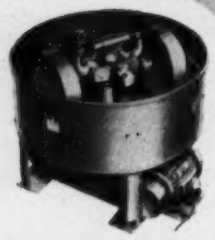
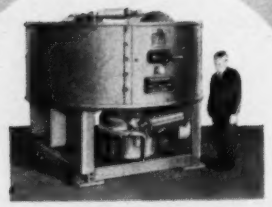
REX HIGH SPEED • TOOL • REZISTAL STAINLESS • MAX-EL • ALLOY • SPECIAL PURPOSE STEELS

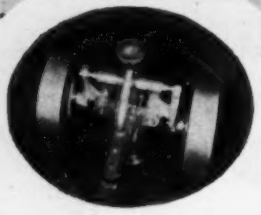


No. 2F MIX-MULLER
6'8" pan dia.
30 cu. ft. capacity
30 H.P. Motor



No. 3-F MIX-MULLER
8'4" pan dia.
60 cu. ft. capacity
75 H.P. Motor

SIMPSON



No. 1½ Model F MIX-MULLER
5'4" pan dia.
15 cu. ft. capacity
15 H.P. Motor

No. 1 Model F MIX-MULLER
4'2" pan dia.
7½ cu. ft. capacity
7½ H.P. Motor

PORTO-MULLER
3'3" pan dia.
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3 H.P. Motor
(100% Portable)

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1 H.P. Motor

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EN... ...MEL FRIT....ELECTRICAL PORCELAIN..
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SPICE BLEND... ...ATER SOFTENERS...
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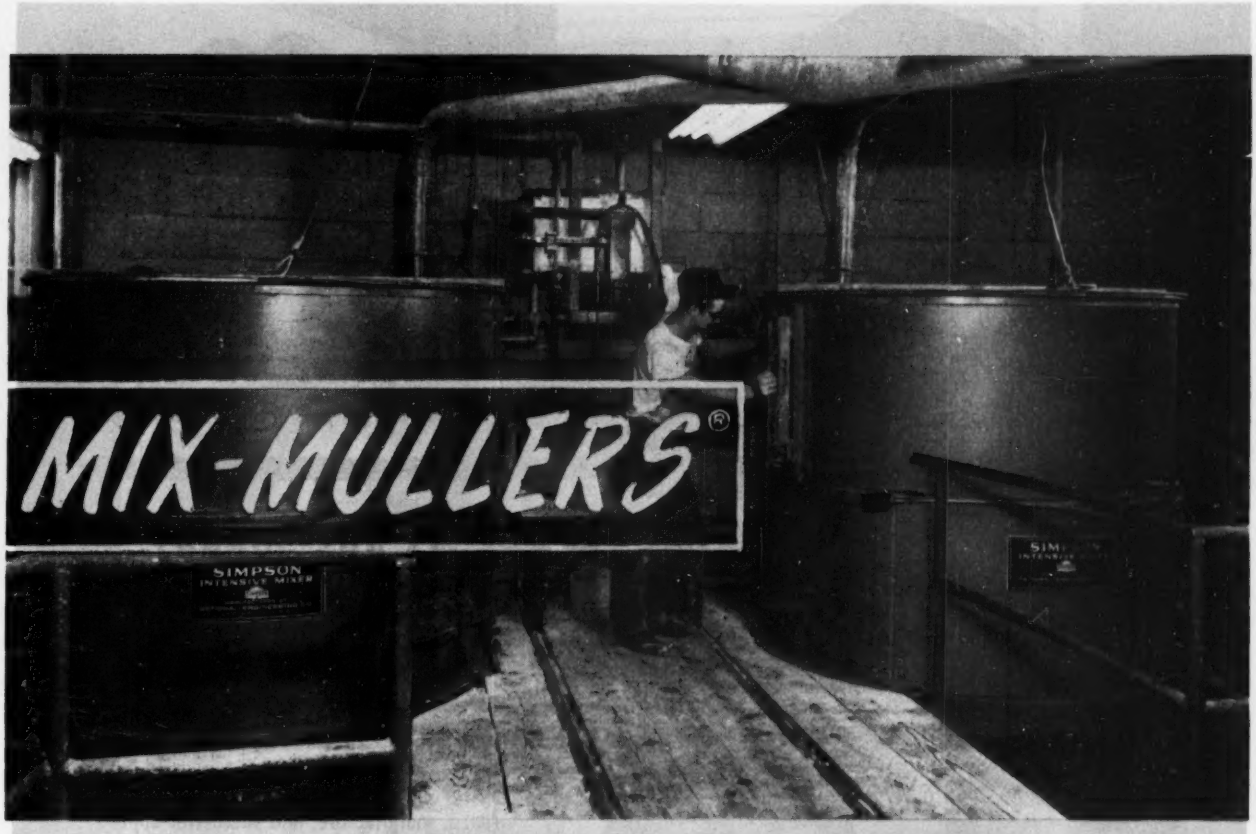

Six New Models and a *NEW DIMENSION* . . . for your Profit Picture

Does your mixing equipment carry a fair share of the responsibility for adequate profit over materials, manpower and maintenance?

Outdated mixing facilities are a costly and wasteful running mate to an otherwise modern process. Adequate hour-by-hour, day-by-day control over critical mixing formulas can pay dividends in product quality and uniformity. Intimate, thorough blending-in of expensive trace or micro-ingredients can turn a previously wasteful operation into a new selling point for your product . . . new ease to your production.

Simpson Mix-Mullers are an important partner in many key processes . . . bringing *shared economy* to a growing number of diversified chemical and Process Industry applications . . . wherever intimate, controlled blending of costly ingredients requires *real* control over materials preparation facilities.

A New Dimension in Mixing Efficiency

Shown on the page at the left are six New Models of the Simpson Mix-Muller.

Each unit in this new "F" series has been thoroughly plant tested to offer the most for your investment dollar. Providing a *new dimension* in mulling efficiency, the "F" Series Mix-Mullers have spring-loaded Mullers for infinitely variable control over mulling pressures . . . V-belt drive, centralized lubrication; simplified, yet traditional rugged design to help cut maintenance and operating costs to a minimum.

Available in 13 models, in batch capacities of 1/10 to 60 cu. ft., Simpson Mix-Mullers may be equipped to meet every processing need . . . as a reaction vessel . . . for heating or cooling while mixing . . . in stainless or other special metals.

Why not see how modern *controlled* mulling can become a full-time partner in your economy? Call or write for details and remember—mixing is our business . . . our only business for over 40 years.

SIMPSON *MIX-MULLER*® DIVISION

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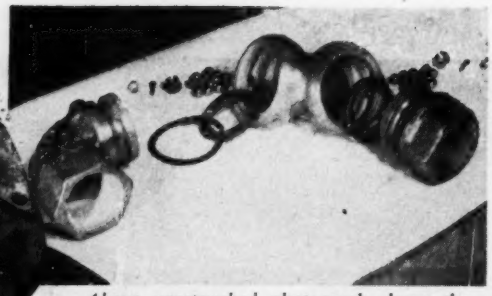
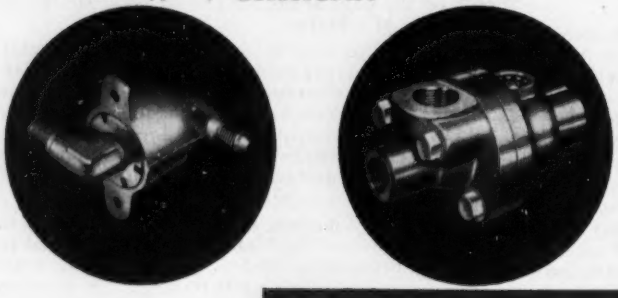


Above unretouched photograph shows the "guts" of the original 2" style 50 single ball race CHIKSAN Swivel Joint after 20 years of rigorous service in the California oil fields. Note the good condition of the wearing surfaces. This joint has been improved through the years to the present modern double ball race joint.

The CHIKSAN Ball Bearing Swivel Joint illustrated above is an unretouched photograph of a veteran of 20 years service on an oil well cementing hose.

CHIKSAN IS NO "JOHNNY COME LATELY" TO INDUSTRY...

Modern types of **CHIKSAN** *swivel joints.*



- Over a quarter of a century of "know-how" in design, manufacture, and successful application of swivel joints.
- Originator and largest exclusive manufacturer of ball-bearing swivel joints.
- The widest range of styles, sizes and pressures available for every major industry.
- Packing designs available for each specific service, assure constant torque at any given pressure.
- World-wide recognition for highest quality and lowest maintenance costs.
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- If you require unlimited flexibility with unlimited life—be sure you *specify* and *buy* CHIKSAN Ball Bearing Swivel Joints.

Supply and Service of CHIKSAN Ball Bearing Swivel Joints is always as near as your telephone. Write CHIKSAN for Specific Catalog Information. Dept. 5-CE

The Flow of Enterprise Relies on

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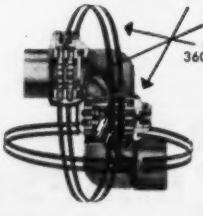
THE NEW TOOL OF MODERN INDUSTRY



CHIKSAN Ball Bearing Swivel Joints are THE NEW TOOL of Modern Industry with full 360° rotation in 1, 2, and 3 planes. Over 1,000 different types, styles, and sizes have been developed for pressures and services from 28" vacuum to 15,000 psi and for temperature ranges from minus 70° to a plus 500° F. with packing materials for each specific service.

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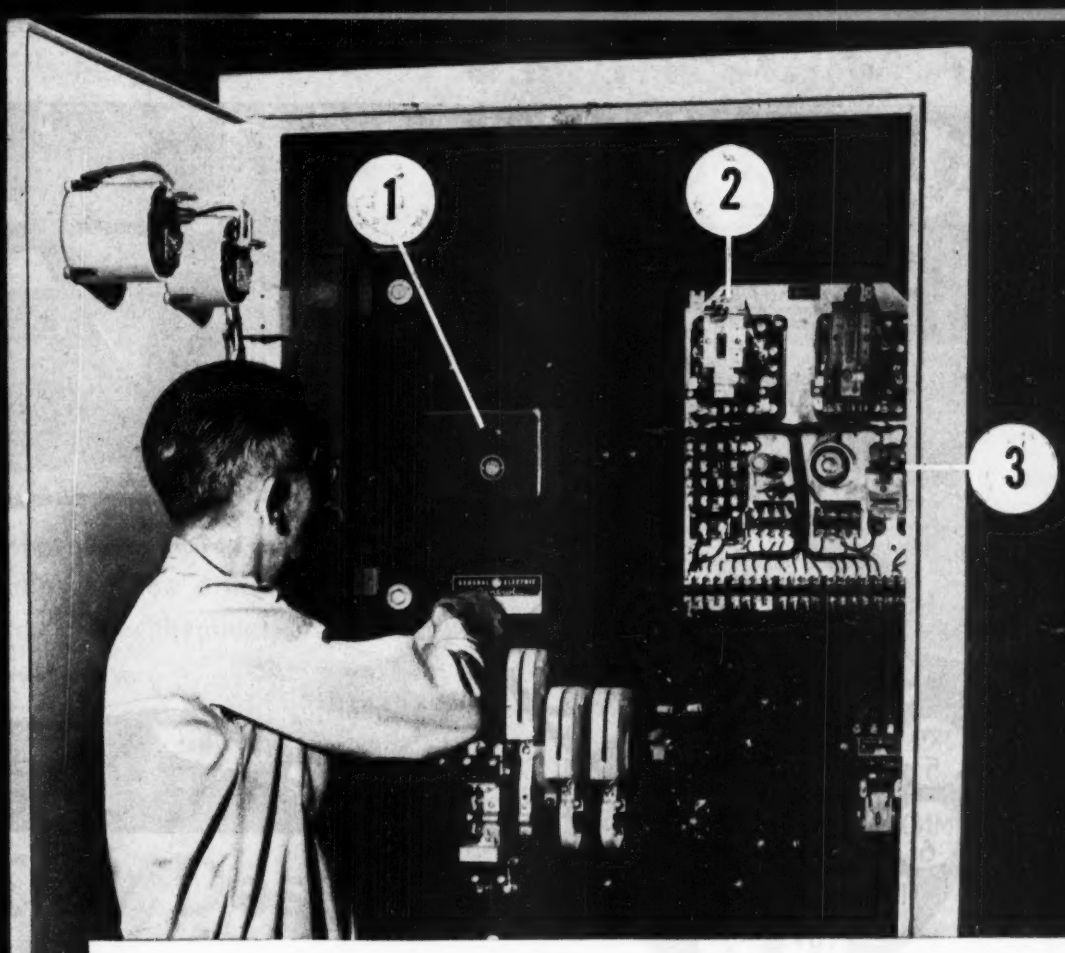
Weil Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Co., Brea, Calif., Newark 2, N.J. • Chiksan of Canada Ltd., Edmonton, Alta.



Only G.E. Gives You These 3 Features in Standard Synchronous Motor Control at No Extra Cost

1. GRADUATED SQUIRREL-CAGE PROTECTION Relay protects motor during stall or subsynchronous operation. Protects squirrel-cage winding against overheating.

2. PRECISION ANGLE SWITCHING Field application relay takes fullest advantage of motor's synchronizing ability—applies field at correct speed and most favorable angle between rotor and stator poles.

3. LOAD ANGLE FIELD REMOVAL Fastest field removal available assures long motor life. Power-factor relay removes field within first half slip cycle out of synchronization.

You get these and other big features in *standard* G-E synchronous motor control at no extra cost. Be sure to get complete details—contact your nearest G-E Apparatus Sales Office or use the convenient coupon to get our new 16-page desciptive bulletin.

Section K 780-3
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Please send me your new bulletin, GEA-5873 which gives complete information on G-E Synchronous Motor Control.

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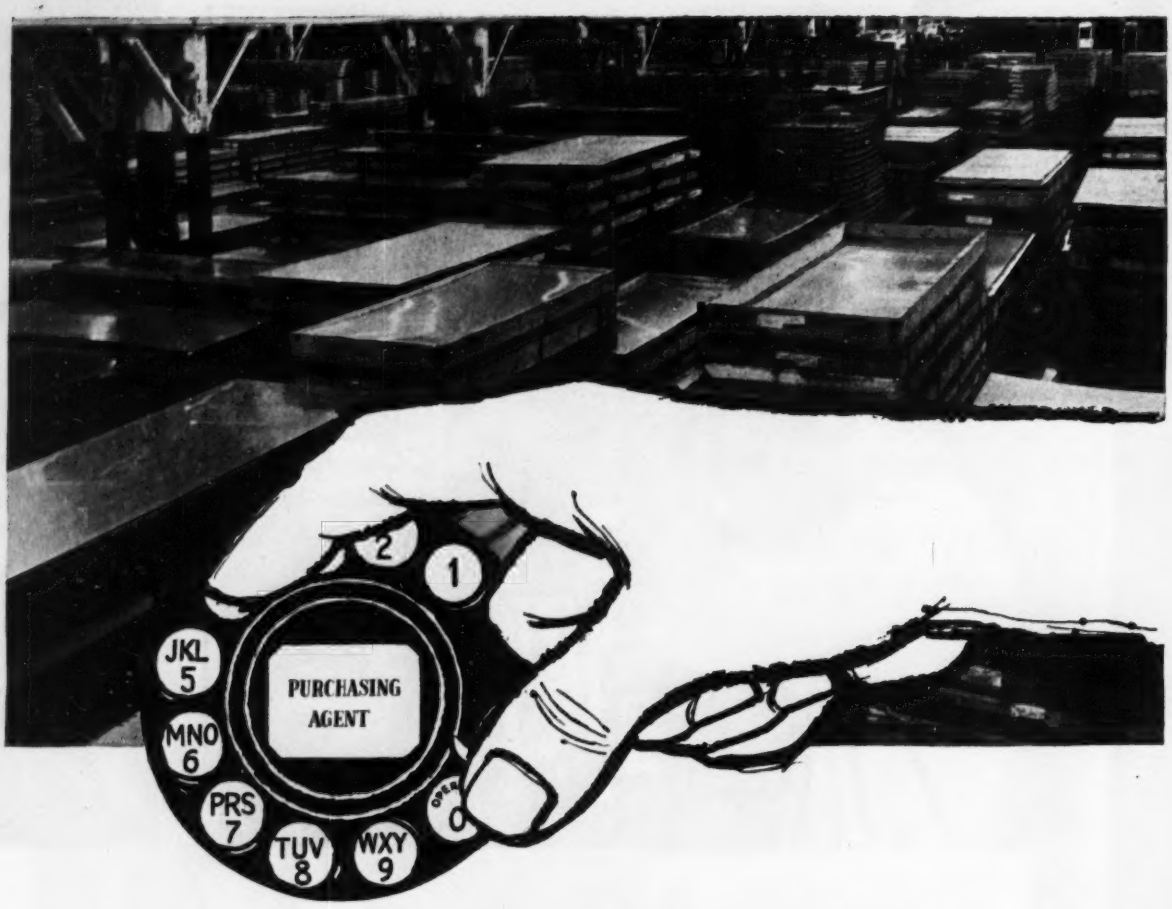
GENERAL ELECTRIC



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Chemical Engineering
MAY 1954

Extensively tested on commercial scale and now available for general use in the chemical process industries, are . . .

Three New Tray Designs

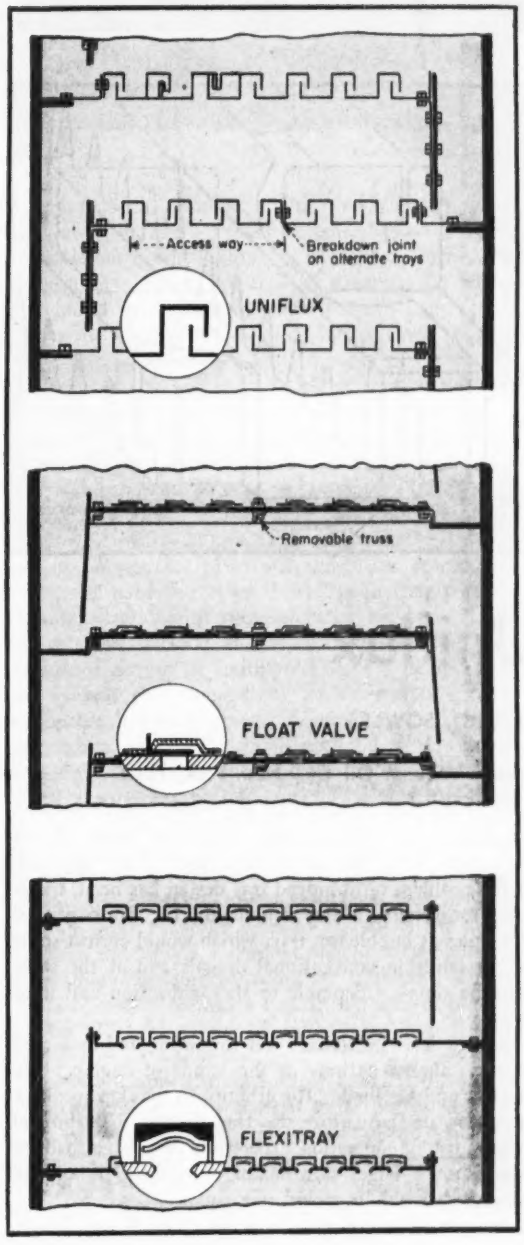
A FIELD of chemical engineering which has lain practically dormant for decades now almost overnight finds itself alive with activity.

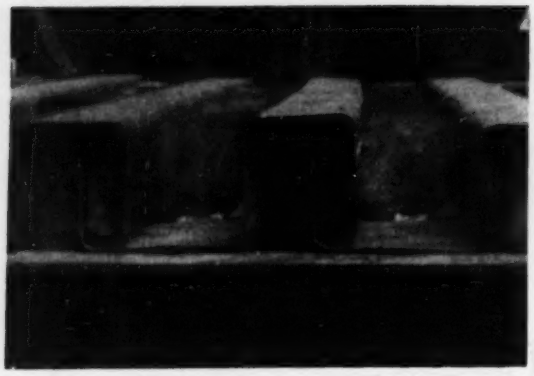
The field—one close to many a chemical engineer's heart—is the design of trays for fractionation and absorption. The activity—long overdue—is the improvement of conventional designs and the development of radically new types of trays.

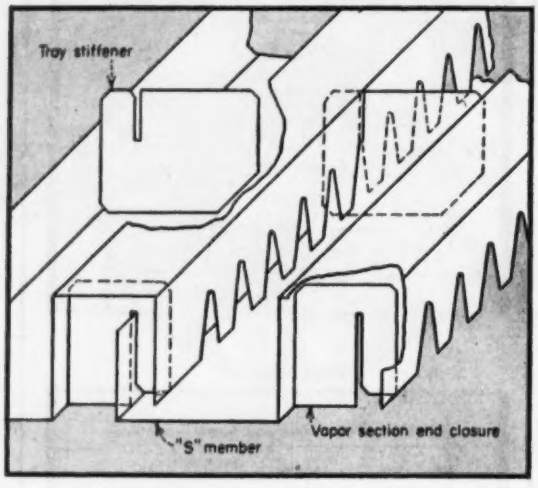
This article reports in detail three recent innovations in tray design:

- Socony-Vacuum's Uniflux tray, which employs the same general operating principles as bubble-cap trays but simplifies the design and reduces the cost.
- Nutter Engineering Co.'s float-valve bubble tray, which replaces bubble caps with floating pivotal valves to achieve high efficiencies over wide capacity ranges.
- Koch Engineering Co.'s Flexitray, which uses liftable disk-type valves to provide wide flexibility in both operation and design.

Chemical engineers will want to check cost and performance data for the newcomers against comparable data for conventional bubble-cap and sieve trays and other recent arrivals on the scene, such as Benturis and Turbogrids.







Uniflux

By V. O. BOWLES

Socony-Vacuum Oil Co., New York, N. Y.

Over the past two decades the experience of Socony-Vacuum with fractionating trays has been almost exclusively with the bubble-cap type. Our approach to the problem of improved tray design has been, therefore, to develop a tray employing the same general principles as bubble-cap trays which would correct some of the faults in conventional designs and at the same time be simple, adaptable to standardization and inexpensive.

Socony has traditionally left the rating and designing of trays almost entirely in the hands of engineer-contractors and has made little attempt to develop specifications for, or standardize on, tray designs. To protect continuity of operation, therefore, we have had to warehouse a large, slow-moving inventory of a great variety of bubble caps and tray parts.

In spite of several notable innovations in tray design, bubble-cap trays are still by far the most commonly used type today and probably will continue to be for some time. This is remarkable when one considers that there have been no really significant improvements in bubble-cap trays during the past 15 years. There have been improvements, true, but more stringent requirements specified by process designers have tended to offset such gains.

Bubble-Caps, Pro and Con

We at Socony have found that fractionators generally operate at ultimate rates substantially in excess of original design rates; only rarely have we thought it expedient to replace, or even significantly alter, any trays. Furthermore, fractionating efficiency of bubble-cap trays appears to hold up remarkably well, even at rates 40 to 70 percent above design.

Our experience indicates that the ultimate capacity of bubble-cap trays is more often limited by downflow restriction than by any other cause. Efficiency, too, suffers in some towers with high downflow, probably because of excessive hydraulic gradient and resultant unequal slot submergence.

Recognizing the good and bad points of bubble-cap trays, Socony has developed an improved version of the bubble-cap tray, the Uniflux tray.

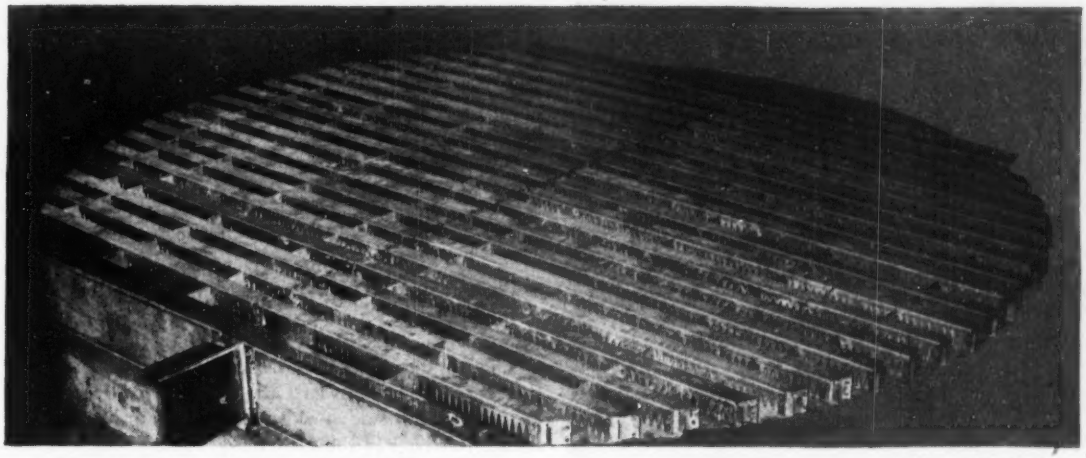
Details of the Uniflux Tray

Fundamental unit of the Uniflux tray is an S member. The vapor section of each S member is enclosed at each end by transverse vapor closure pieces. Intermediate stiffeners fastened at intervals in the trough section insure a good section modulus to the member, especially to the free wall of the trough. The vapor closure pieces and tray stiffeners are slotted so that on assembly the S members are imbricated as shown in the illustrations.

Thus the basic S member has structural as well as functional properties. When fabricated of 16-gage material it has ample strength to span a 10-ft.-dia. tower with negligible deflection under operating and maintenance conditions. In larger towers (up to 20 ft. dia.) a single intermediate support beam is used. No other support beams or purlins are required.

These S members are secured to conventional support rings by a single conventional tray clamp at each end. As seen in the assembly drawing, the S members are assembled by starting from the trough at the downstream side of the tray. The last vapor section is fastened to the vertical flange which is a part of the segmental section at the foot of the downcomer. For trays having more than seven S members, a split S member is provided on alternate trays so that the operator has vertical access for maintenance, cleaning and inspection.

The segmental downcomers are similar to those of conventional bubble-cap trays, except that they are standardized and are designed to insure unrestricted downflow. Where downflow requirements are very large the vertical flange of the segmental section at the



Bignier-Schmid Laurent

inlet side of the tray is extended upward to provide a proper seal for the downcomer at the inlet to the tray.

Double crossflow trays use the same basic S-member elements and resemble the single crossflow design just described.

Operating Characteristics

Available slot area is about 12-14 percent of superficial tower area, or generally equivalent to that provided in conventional bubble-cap tray designs. Since the slotted sections are well separated, there is no interference of the vapors issuing from one slotted element with those issuing from another. The entire length of the slotted sections, therefore, is fully effective.

Furthermore, the vapors issue forth in only one direction and in such a manner as to boost the liquid across the tray. This compensates for hydraulic gradient under all conditions of flow. Running slot submergence is thus uniform across the tray.

Riser area usually is two to four times that provided in bubble-cap tray designs. Likewise, reversal area and equivalent annular area are large. The Uniflux tray therefore has a lower fixed pressure drop (exclusive of pressure drop due to slot submergence) than bubble-cap trays.

Data now available show that the combination of equal slot submergence (compensated hydraulic gradient), low pressure drop and elimination of areas of interference will result in measurable performance advantages. Within a few months we expect to have enough reliable information to assess more quantitatively these anticipated performance advantages.

Other Advantages of Uniflux Trays

In the meantime, Socony-Vacuum has taken the position that these trays merit attention even on the basis of merely equivalent performance. Since the Uniflux design combines functional and mechanical features, the tray is light in weight and thus less expensive than comparable bubble-cap trays. Uniflux trays made of 16-gage material, complete with downcomers, weigh only about 8 lb. per sq. ft. of superficial tower area.

Fabrication is very simple. Trays can be made with standard press brakes, shears and die-stamping equipment found in many light metal shops.

Thus the Uniflux tray is quite inexpensive. Experience in the purchase of a large number of these trays indicates costs on the order of 60 percent of the cost of conventional bubble-cap trays of similar material.

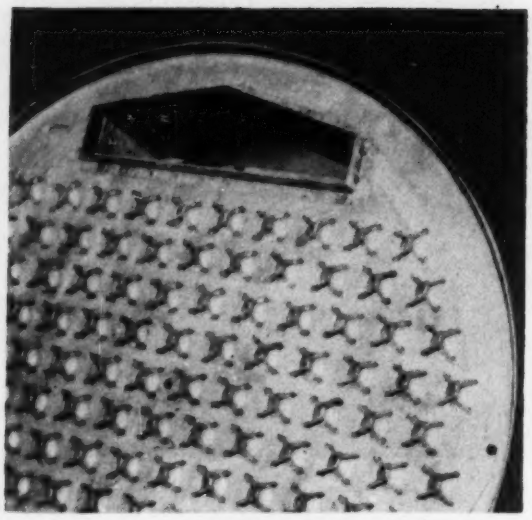
Warehousing of spare parts is simple. For example, if a new refinery is using Uniflux trays throughout, it need have on hand only an appropriate number of S members approximately 10 ft. long and a suitable supply of vapor closure pieces and tray stiffeners. A suitable stock of 16-gage flat plate will suffice for downcomer aprons, seal pans and other miscellaneous tray parts.

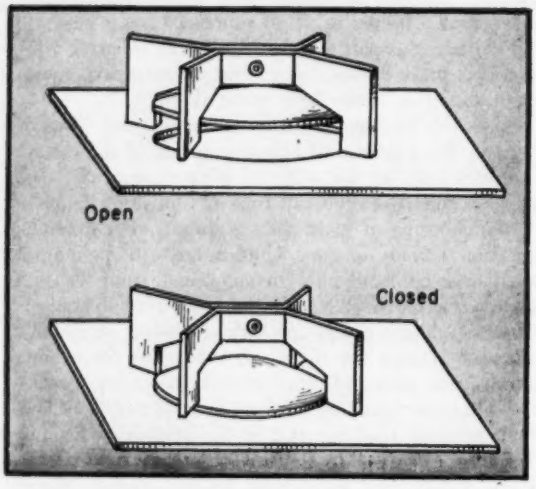
Uniflux fractionating trays are in service on a 17,500-bpd. catalytic cracking unit at the refinery of Socony-Vacuum Francaise in southern France. Applications there include feed preparation towers, reactor effluent fractionator and its strippers, amine absorption system, hydrocarbon absorber, debutanizer and a side-stream stripper for recovering butane from the debutanizer.

Performance has been completely satisfactory from the start. The management in France is especially impressed by the low cost of the trays and by the very low maintenance requirement since operations started.

At the present time Uniflux trays have been installed or are on order for more than 130 fractionating towers both here and abroad, including the entire fractionating tray requirements for two complete refineries. Towers now in operation include a naphthenic acid distillation unit, an HF acid stripper, debutanizers, depropanizers and coker unit fractionator.

Socony-Vacuum is making the Uniflux tray available to the petroleum and chemical industries at a fee of $1 per sq. ft. of superficial tower area per tray. Fabricators will be licensed to construct Uniflux trays, and this fee will be included in the tray quotations by the fabricators. At the present time four U. S. fabricators and one in France can furnish quotations.





Float-Valve

By I. EARL NUTTER

Nutter Engineering Co., Amarillo, Tex.

Float-valve bubble trays grew out of a study of bubble tray performance started in 1945. Purpose of this study was to produce a bubble tray of high capacity and superior efficiency which would also operate with good efficiency at reduced capacity.

The term "float valve" refers to a floating pivotal valve that is heavier on one edge than on the other. It is retained on the tray in a manner which limits its vertical or horizontal movement. As vapor passes up through the tray, it first pushes up the light edge of the valve, which pivots at the heavier edge. At higher vapor velocities, the heavier edge is pushed upward, pivoting at the light edge.

Float valves may be constructed in many forms in accordance with this basic principle. Of the several forms investigated, the one described here was selected for commercial use because of its simplicity, economy of construction and adaptability to suit various performance requirements.

The float valves and the openings beneath them are arranged in rows across the tray. The ends of the valves are loosely held in retaining brackets which are secured to the tray by rivets. Valves and brackets are generally made of 20-gage stainless steel.

One edge of each valve (excluding the end portions retained by the brackets) extends laterally outward and then turns up to form an L-shaped section. Because of the offset to one side in width and the upward-extending flange, this edge of the valve is the "heavy" edge.

The openings in the tray floor extend the full distance between bracket edges. The tray deck is solid underneath the brackets themselves to retain structural strength. Slots centered across the top of each bracket permit the escape of gas off the ends of the valves so as to purge, or sweep away, any solids that might accumulate under the brackets and interfere with movement of the valves.

How Float-Valve Trays Operate

Assume that the liquid phase, such as in an absorber, is turned on first. The liquid flows smoothly across the tray at right angles to the rows of valves (the light edges usually face into the flow).

There is a minimum of gradient because of practically no obstruction. However, even at low flow rates sufficient gradient exists to submerge the valves near the entrance side in more liquid than on the exit side. At no gas flow the valves remain closed, even with maximum liquid flow, because the weight of the liquid downward is always greater than the lateral force of liquid flowing across the tray against the flange of the valve.

In the absence of gas flow, a small amount of liquid will weep through the valves because of imperfections of fit. However, this weeping stops as soon as gas flow starts up through the tray.

The first small flow of gas brings into operation the light edges of the row of valves nearest the exit weir. As rate of flow increases the light edges of additional rows of valves, working toward the entrance downcomer, come into operation. At about 20 percent of gas-phase design loading, irrespective of liquid loading, all the valves on the tray are in operation and the tray functions at full efficiency.

As gas flow increases further, pressure drop through the valves increases, until at about 40 percent of design loading the heavy edges start to rise. At about 70 percent of loading all valves are in fully open position. Beyond this point full loading is reached by increased pressure drop through the valves in fully open position.

At loadings beyond approximately 20 percent of de-

sign the float valve is fully stabilized in movement through firm dampening engagement of the ends of the valve in the retaining brackets. This feature distinguishes the float-valve tray from other trays where the stability of the valve movement is not achieved until the valve is wide open.

At all rates of operation, the gas flow is directed horizontally into the liquid, thus eliminating "blowing dry" or "coning" experienced in most other types of trays using vertically directed flow.

Experience to Date

The first installation of float-valve trays was made in September 1951. This was a 6-ft.-dia. absorber with 16 trays on 24-in. spacing. It operates at 225 psi. in a natural gasoline plant in Carson County, Tex.

This absorber was equipped for careful measurement of all operating variables and has been tested three different times. Calculations show a tray efficiency of about 75 percent. In contrast, similar tests in the same plant on conventional absorbers in the same service gave efficiencies between 14 and 30 percent.

The test absorber has been loaded to full gas capacity, 2.1 million std. cu. ft. per hr., at which point the tower did not flood but frothed excessively. Upon load reduction of less than 1 percent, stable operation immediately resumed.

Three absorption plants have replaced older trays with float-valve trays. Gas and oil capacities have been increased thereby to such an extent that in all instances the cross-sectional area of the towers left in service is about half of that originally used. In most instances the extra towers have been put into other services.

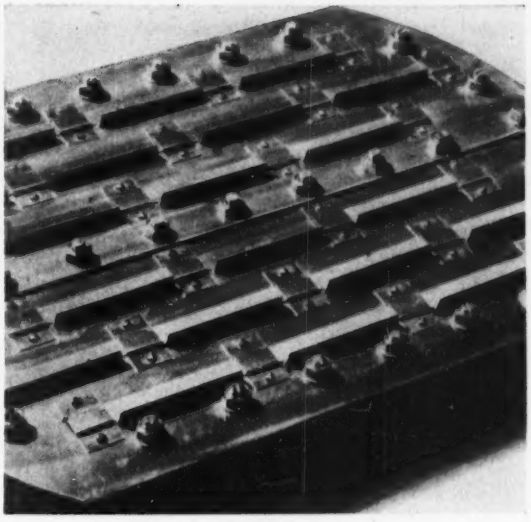
The first installation of float-valve trays in a stripping still was made last July. This is a 6½-ft.-dia. tower with eight double-flow trays on 24-in. spacing; it replaced two 6-ft. towers operating in parallel with six single-flow trays each.

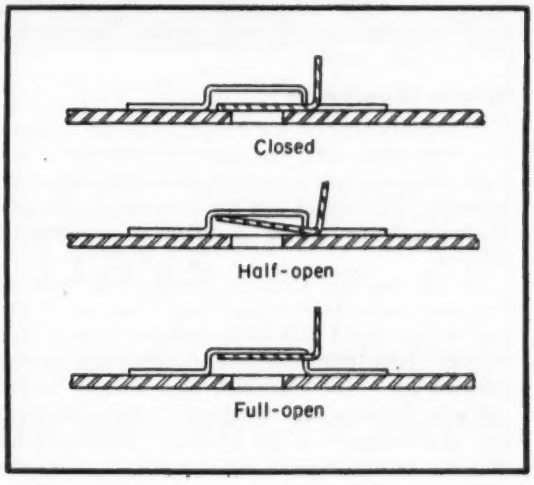
This still was designed to handle 2.25 million gal. per day of lean oil, but available oil pump capacity has limited the loading to 1.97 million. The levels of liquid stack-up in the downcomers indicate that the tower could easily handle the 2.25 million gal. at 90 percent of flood-point loading.

Tray efficiency of 100 percent was assumed in design; operating results show this performance is being realized. In comparison to the old stills, this still is now handling twice the load per sq. ft. of cross-section and using half the stripping steam.

First installation in a fractionator was also made in July. This is a 4½-ft. depropanizer with 30 trays on 18-in. spacing. Although adequate test data are not available, tower operation is extremely smooth; abrupt changes in feed or reflux rates are not reflected on the temperature or pressure recording controller charts.

All told, 20 installations of float-valve bubble trays are in service, with seven more on order. Of these installations, there are ten absorbers, four reabsorbers and two each of fractionators, stills and demethanizers.





Flexitray

By G. C. THRIFT

Koch Engineering Co., Wichita, Kans.

In many towers of a single diameter there are zones whose throughput is lower than in other, more heavily loaded parts of the tower. In such zones high-capacity trays (such as the Benturi) are not necessary and can be replaced by a flexible tray design of sieve-tray capacity with moderate price.

Such a tray is the latest addition to the Koch tray family, the Flexitray, so named from one of its outstanding characteristics, that of extreme flexibility in both operation and design. Its operation is reminiscent of the familiar rivet tray. Some of the latter's short-

comings have been eliminated and other advantages added.

Design Details

The Flexitray has liftable valves of approximately 2 in. dia. retained by four-posted, plate-stamped spiders attached to the deck on a triangular pitch of 3 to 6 in. in a manner similar to bubble-cap trays. Downcomers are conventional, either chord or conduit type.

The holddown member is attached to the deck by clinching a projection of each of the four guide legs on the under side of the deck. The valves and holddowns are furnished in alloy, even though the remainder of the tray may be carbon steel.

Alternate rows of caps have different weights. The lighter caps open during the first 20 to 30 percent of tray loading. The heavier caps open from this range to 50 to 70 percent of capacity. At higher rates all caps remain thrust open against the holddown spider.

The present design of cap and holddown have been fatigue-tested through more than 5 million cycles of complete opening, striking the retainer, then striking the seating surface. This test is thought to represent many times the abuse of actual tray life. No deterioration has been noted.

Operating Characteristics

In normal operation the Flexitray may be compared to a sieve plate, with one important difference. The highest vapor velocity is directed horizontally rather than vertically. This means that the sieve plate's difficulties of blowing dry or "coning" in certain ranges are greatly reduced

At high loadings when the valves are all open the tray resembles a bubble tray, except that no obstruction to the liquid flow exists and the vertical vapor velocity above the more violent contacting zone is relatively low. The usual high vapor velocity directed vertically between the cylindrical surfaces of bubble caps is not present in the Flexitray. In effect practically the entire height of the cap and riser has been eliminated. High velocity exists only at deck level, well submerged in the liquid, whose mass assists in evenly distributing the vapors throughout the entire mixing mass.

Streamlining and proportioning of the vapor passages have reduced the over-all pressure drop below that of sieve plates. Mayfield et al (*Ind. Eng. Chem.*, 44, 2239, 1952) indicate that with sieve plates on air and water, 18-in. spacing, pressure drop at full rating varies from 6 to 8 in. of water. Under the same conditions the Flexitray can be designed for 2.5 to 3.5 in. water pressure drop. This means that Flexitrays can use smaller downcomers than required by sieve trays.

Advantages of Flexitrays

The Flexitray combines a capacity approaching that of the best designed sieve tray with an efficient and flexible operating range at least equal to that of bubble trays. In the ranges of high liquid-vapor ratios its flexibility exceeds that of bubble trays. Developments now under way indicate that by combining certain features of the Koch Benturi tray with the Flexitray further capacity increases will result.

Excessive liquid gradients on bubble trays cause maldistribution of vapors and even runback down the risers. Since the maximum height of any obstruction on the Flexitray is only about $\frac{1}{4}$ in. the maldistribution due to any hydraulic gradient is practically nil.

Unlike sieve trays, no precision leveling of the tray supports is necessary. Using caps of two or more different weights insures vapor distribution at low operating loads even when the tray is inadvertently installed out of level. No gaskets are necessary, since even at the lowest loadings vapor weeps up through any crevices.

Perforations on sieve trays are generally $\frac{1}{8}$ to $\frac{5}{16}$ in. dia., whereas the minimum vapor passage on the Flexitray is $\frac{1}{4}$ to $\frac{5}{16}$ in. This increased dimension plus streamlining of the passages should increase the on-stream time over sieve trays in semidirty service.

Commercial Installations

Koch has made 19 commercial installations since introducing the Flexitray last year. These are mostly in petroleum refineries and natural gasoline plants, in such services as debutanizers, cracking-unit fractionators, product strippers and the like. Pressures range up to 500 psi. and trays spacings from 12 to 30 in. Shorter tray is $\frac{1}{4}$ to $\frac{5}{16}$ in. This increased dimensions plus stream

Efficiency data indicate that for a given separation fewer Flexitrays than bubble trays may be required This is particularly true on absorbers and strippers where relatively viscous matetials are handled. It appears that absorber tray efficiencies in the range of 70 to 90 percent may be expected instead of the usual bubble-tray efficiencies of 25 to 30 percent.

Prices are at present competitive with bubble trays and additional tooling will bring prices even lower.

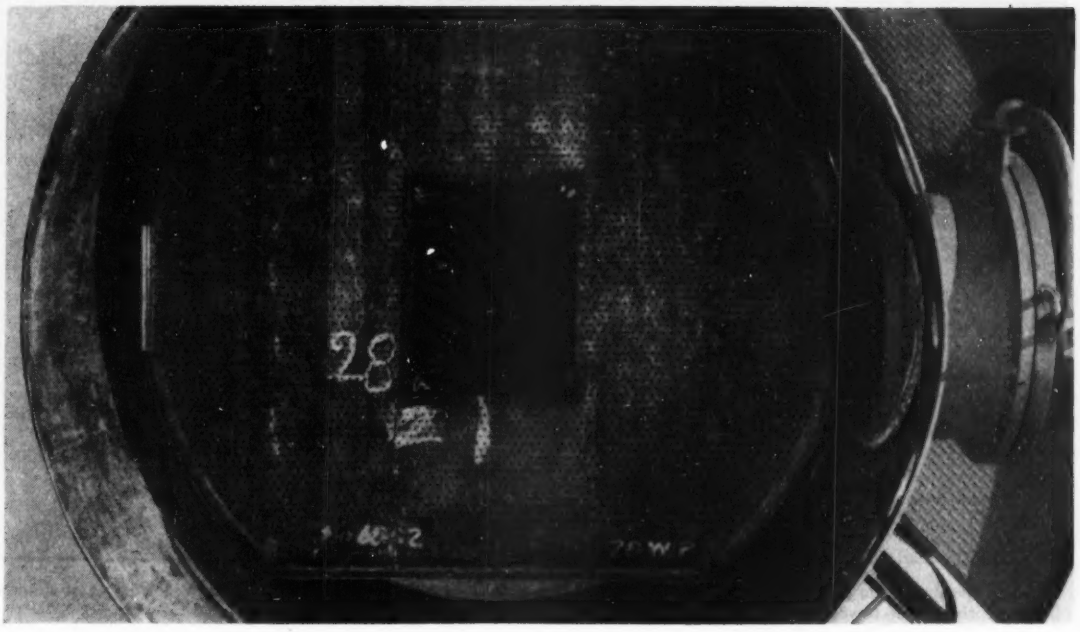
Acknowledgment

These three articles are abridged versions of papers presented to the California Natural Gasoline Association meeting in Los Angeles in January. We thank CNGA for permission to publish them here.—Editor.

ALSO IN THIS ISSUE

. . . are three more articles reporting the latest developments in other types of fractionating trays:

Kaskades ..... p. 124 Bubble-caps ..... p. 128 Sieve trays ..... p. 179



Sieve Trays

- **Cheaper and more efficient, for many applications, than bubble caps.**
- **New design data helps you design sieve plate columns more effectively.**

D. C. LEE JR.

Perforated plates have been used for many years in distillation and absorption columns, but their popularity has never equaled that achieved by bubble plate columns.

The greater application of bubble trays has been due largely to the lack of available design data on perforated plates and to the ease of "rough design" of bubble cap trays. Sieve plates have been reported to suffer from a narrow operating range, while bubble cap trays operate well over a fairly wide range of rates. However, certain features of perforated plates—low cost, high efficiency, high capacity, and resistance to fouling—make their use attractive if reliable design information is available.

Until the summer of 1949 the experience of the Celanese Corporation of America had been limited to conventional bubble cap trays. At that time an experimental study of perforated plates was started. This was for the purpose of (a) making a visual comparison of the behavior of perforated plates with bubble cap trays, (b) determining the operating range limitations of perforated plates, and (c) developing sieve plate design methods. The experimental results, which have previously been reported[2], indicated that properly designed sieve plates would have a wide range of stable, efficient operation, and that the use of perforated plate distillation and absorption columns would be desirable. Data by other authors[1, 3, 4] have also stressed that sieve plates can be designed to give a wide range of high efficiency operation.

D. C. LEE, JR., *is a chemical engineer with the Chemical Division, Celanese Corp. of America at Bishop, Tex. He delivered this paper at the January meeting of the California Natural Gasoline Association in Los Angeles.*

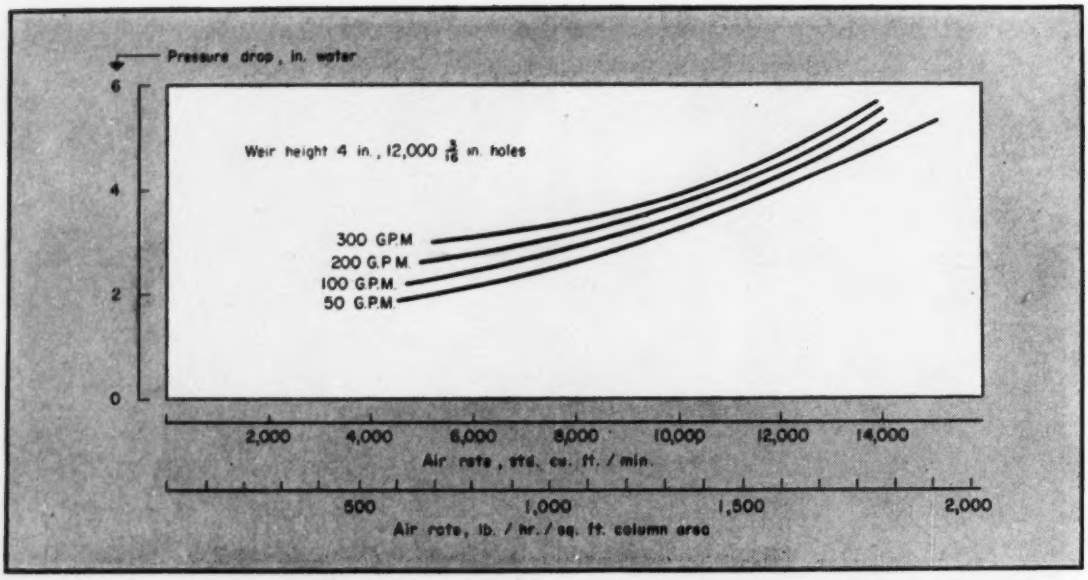


Fig. 1—Typical pressure drop correlations for a 6½-ft. dia. sieve plate, on an air-water system. It shows the effect of different liquid depths on the trays. The curves cover a range of water rates from 50 to 300 gpm.

HOW DATA WAS DEVELOPED

Experimental work was performed on a 6½-ft. dia. column, with a single sieve tray operating on the air-water system. Manometers were used for measuring pressure drop across the tray. Liquid depths on the tray performance were observed from above the tray and also from below the tray, through windows. Data were taken on such operating variables as the weep point, the maximum vapor rate possible, and pressure drop.

Runs were first made on ⅛-in. dia. holes. These were later drilled out to 3/16-in. holes and then ¼-in. holes. For each hole size, varying numbers of holes were used to check the effect of percent hole area, and various outlet weir settings were used to investigate the effects of different liquid depths on the trays. Fig. 1 is a plot of typical data obtained during the runs, with the curves showing the actual limits of good operation.

Orifice coefficients determined from pressure drop measurements on the 6½-ft. dia. tray were not always consistent; particularly with the ⅛-in. dia. holes, because of errors introduced by a nonuniformity of hole size and shape due to hand drilling and worn drills. Therefore, a separate pressure drop study was made in a 6-in. dia. columns. In this work, after carefully drilling the holes to exactly ⅛-in., 3/16-in., and ¼-in. hole sizes, the various tray spacings, plate thickness and drilling patterns were studied. The calculated orifice coefficients for the dry tray pressure drop were essentially constant at about 0.85—with the plate thickness drilling pattern and hole diameter having no appreciable effect on the coefficient over the range studied.

We expanded the study of the pressure drop through dry trays in the 6-in. dia. column to investigate the effect of liquid on the orifice coefficient. This demonstrated that the dry orifice coefficients were not appreciably affected by the presence of the liquid above the holes. For design purposes the total pressure drop through a sieve tray could be determined by adding the individual pressure drops through the dry tray and through the calculated depth of liquid.

AERATION FACTORS

In analyzing the wet tray pressure drop data obtained on the 6½-ft. dia. tray, it was noted that the observed pressure drop through the liquid on the tray—which was determined by subtracting the dry tray drop from the observed total pressure drop—was in some cases greater than the calculated clear liquid depth on the tray and in other cases was less than the calculated value. Aeration factors, defined as the ratio of the observed pressure drop through the liquid to the calculated clear liquid head, were calculated from this data. A correlation of this aeration factor as a function of liquid depth on the tray is shown in Fig. 2, which shows the general trend of decreasing aeration factors with increasing liquid depths.

This correlation gives an estimate of the pressure drop through the liquid on sieve trays as a function of weir height and liquid rate. In the range of outlet weir heights normally used (1 in. to 2 in.) the aeration factor is less than 1.0. Since these data are for the system air-water and the effect of different liquid and vapor densities on the aeration factor is not known, an aeration factor of 1.0 is normally assumed for design purposes. This is so the actual pressure drop through the liquid will be on the safe, or low, side.

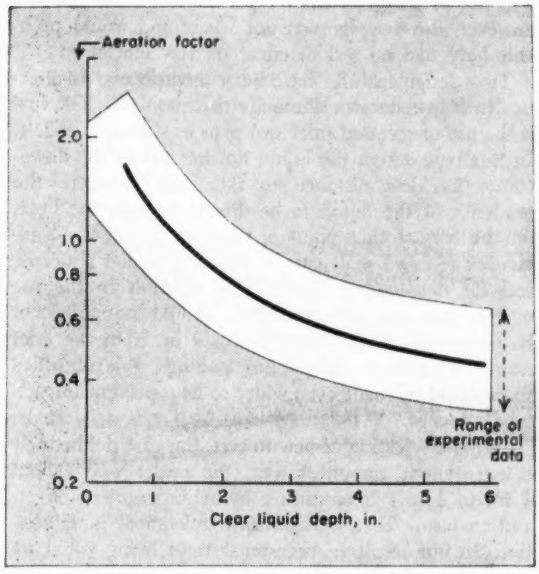


Fig. 2—Aeration factor. Experimental conditions—air rates of 4,000 to 16,000 SCFM; 1/8, 3/16-in. holes.

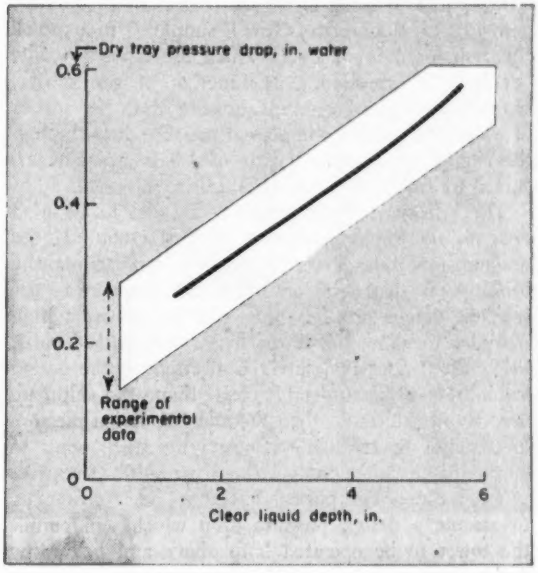


Fig. 3—Weep point correlation. Experimental conditions—water rates of 50 to 300 gpm.; 3/16-in. holes.

OPERATING RANGES

The data in Fig. 1 provides an indication of the wide range of stable tray operation which was obtained in the sieve plate study. The vapor rate at the upper limit of good operation in this series of runs is about 14,000 SCFM. The lower limit on the vapor rate—the point at which liquid began to weep through the holes—is about 5,000 SCFM. This corresponds to a stable operating range of 100 percent vapor rate down to 36 percent. Data on plant columns show operating ranges equally wide or wider.

A simple correlation of the minimum allowable vapor rate on the experimental sieve plate for the air-water system is shown in Fig. 3. Here the calculated liquid depth on the tray was plotted against the pressure drop necessary to support this amount of liquid without weeping. This correlation does not include such factors as surface tension, kinetic energy of the vapor, and tray diameter, which quite possibly have some effect on how far the vapor rate can be reduced. However, operating data from several perforated plate columns indicate that the correlation is a fair method of estimating the minimum vapor rate for design purposes. Additional experimental data are needed for a more generalized correlation.

It was concluded that $\frac{3}{16}$-in. holes are generally the most desirable hole size for commercial use. The smaller holes appeared to give better vapor-liquid contacting, with the $\frac{3}{16}$-in. holes almost as good as the $\frac{1}{8}$-in. holes. The use of $\frac{1}{8}$-in. holes, with heavy-gage plate, is normally not practical when punched holes are used because of the mechanical limitations of the hole punching process. The $\frac{1}{4}$-in. holes, although being the cheapest to fabricate and the most resistant to fouling, appeared to give poorer vapor-liquid contacting due to wider spacing of the holes and to a tendency of the vapor to jet through the liquid.

SUPERIOR PLATE EFFICIENCY

Visual observations of the air-water contacting obtained with the perforated plate indicated that the tray efficiency should be higher than for a bubble-cap tray. Soon after the completion of the experimental work, a 60-tray, 6.0-ft. column was designed and installed at the Celanese Chemcel Plant. Performance checks confirmed the expected high capacity and wide operating range at high efficiency. Comparison of overall tray efficiency with that of a bubble-cap column in the same service, showed the sieve plate column to have a flatter efficiency curve and one which exceeded that of the bubble-cap column by 5 percent to 15 percent. The superior plate efficiency of sieve plates has also been reported by Jones and Pyle[3].

HOW TO DESIGN SIEVE TRAY COLUMN

Design of a sieve plate column follows the same line as the design of a bubble plate column. The column diameter, number of trays, tray spacing, and downcomer dimensions are arrived at in the same manner as for bubble trays. Allowance can be made for the somewhat higher capacity and higher efficiency of the perforated plate column if sufficient data are available for such close sizing of the column.

In designing the proper number of holes for the tray, the major consideration is that of calculating pressure drop through the dry tray and estimating the desired range of pressure drop for the design conditions. The pressure drop is calculated by a suitable

orifice equation using an orifice coefficient of 0.85 for ⅛-in. to ¼-in. thick plate. This is simplified to a special equation for ¾-in. holes, in which the vapor flow rate per hole is expressed as a function of gas gravity, temperature, pressure, and pressure drop in inches of water. To get the component pressure drop through the liquid, an aeration factor of 1.0 is normally assumed for outlet weirs of about 2.0 in. in height.

The selection of the number of holes to be used depends on the requirements of the system. If the design vapor rate is very high—say approaching the limiting rate based on cross-sectional tower area—the selected design pressure drop can be relatively high in order to allow the tower to be operated at much lower vapor rates if desired. Conversely, if the design vapor rate is considerably less than the ultimate capacity of the tower, then the selected design pressure drop might be taken much nearer the weep point to permit higher vapor rates without a resulting excessive pressure drop. For normal operation, it is customary to assume a design pressure drop which will permit the tower to be operated both above and below the design rate.

For cases in which the vapor rate changes considerably from the top of the tower to the base, it is necessary to calculate the hole requirements at several points through the tower. In cases of this sort where the hole requirements vary through the tower, it is customary to drill all trays with the maximum number of holes and use blanking strips tack-welded to the trays to obtain the desired number of holes in each section of the tower. Carrying this a step further, it's possible to perforate all trays with a certain standard minimum hole spacing in cases where there is a chance that the tower service might be changed to require additional holes at some later date. A common hole arrangement in cases of this type is ¾-in. holes on a ¾-in. triangular pitch where 18-in. tray spacing is used. The use of blanking strips is advantageous in permitting the use of the optimum number of holes for each tower service to maintain high tray efficiencies in all cases.

ELIMINATION OF WEEPAGE

A feature of sieve tray operation, which was noted in the visual study of the 6.5-ft. dia. tray, was the premature weeping of liquid on the inlet side of the tray due to the impact head developed by liquid as it overflowed the inlet weir. This was particularly true at high liquid rates in which cases the tray began weeping at relatively high vapor loadings. In general, however, the weepage was not severe and would probably have had no serious effect on tray efficiency.

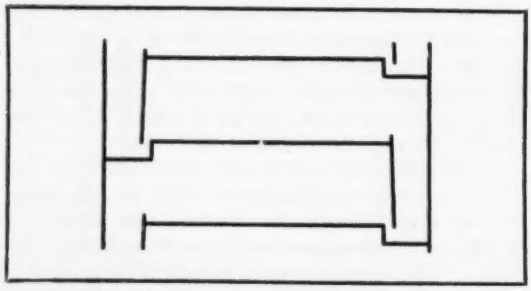


Fig. 4—Detail of sieve plate arrangement.

Two design features have been incorporated in practice to help reduce or eliminate this problem. The first is the use of recessed inlet seal pans as shown in Fig. 4. In this type design the liquid flowing out of the downcomer has less distance to fall, and therefore the tendency of the liquid to be driven through the holes on the tray at that point is reduced. Another advantage of recessed seal pans is that it provides a deeper seal for downcomer backup. In addition to the use of recessed seal pans the trays should normally not be perforated closer than 2 in. to 4 in. from the inlet weir. In cases of high liquid loadings, this undrilled space could be made even wider to help prevent impact-type weepage.

In the fabrication of new towers, trays are deliberately tilted a slight amount toward the outlet weir (about ⅛ in. to ¼ in.) to minimize hydraulic gradient effects and to insure that workmanship tolerances in fabrication do not result in occasional trays being tilted towards the inlet weir.

The use of punched holes has led to one possible inaccuracy in the design methods although operating data to date has shown no appreciable errors from this source. The perforating process tends to shear or tear the material from the tray after the punch has penetrated about half way through. This gives a clean sharp hole only part of the way through the tray and a rather ragged, enlarged hole the remainer of the way. By placing the sharp edge of the holes down, any changes in the orifice coefficient are minimized. Actual measured pressure drops in columns with this type tray have checked fairly closely the values calculated from orifice coefficients for smooth drilled holes.

APPLICATIONS

Most new columns for the Celanese Corporation are now sieve tray installations. More than 70 sieve tray columns have been installed in the last three years, the largest being one of 11-ft. diameter. Where a few replacement trays are needed in corrosive sections of bubble cap columns, sieve plates are commonly used as the replacements. The reason for the selection of sieve trays is to make use of their advantages when proper design methods are available.

The first cost of a sieve tray column is substantially less than for a bubble-cap column, even if no reduction in column size is made. Estimates of the costs of the plates alone show that sieve plates cost only 25 to 50 percent as much as bubble-cap trays. With the sieve tray installation, greater capacity and efficiency are realized, and the range of operation is satisfactorily wide for normal operation. Finally, because it is easier to work inside the columns, maintenance is facilitated.

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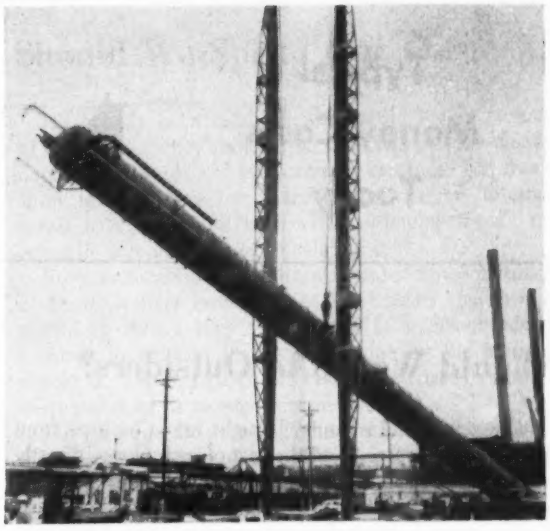
Are you planning expansion?
▸ *You'll need money.*

Will you borrow or use your own?
▸ *And all money has time value.*

Do you know what money really costs?
▸ *You'd better.*



Don't Be Fooled by Interest Rates

WARREN H. BUELL

When you make an economic study for a proposed new plant, it's not too difficult to assign dollar costs to most items involved. Adequate engineering studies of the plant and its operations readily define such outlays as equipment, wage rates and utility charges.

Unfortunately, pinpointing the right charge for the capital you're going to need is much harder. Opinions as to the best way to select and apply interest rates vary all over the lot, so several methods must be considered. And you'd better pick the right one.

No matter how good your engineering, a miscalculation of interest costs can be disastrous. If you estimate too high, a really good project may die on paper. If you're low, your company may be enticed into a very unsound investment.

MONEY COSTS MONEY

It's an inescapable fact of our economic life that money has a time value—it costs money to use money. If you borrow from a bank to buy a house, your monthly payments include interest, the cost of using the bank's funds for that month.

And this is just as true for a multimillion dollar enterprise as it is for an individual. The cost of capital is as real—and as inevitable—as the cost of payrolls and property taxes. It must be treated in the same way as any other item of expense. Including interest charges in your estimate brings out a hidden cost and provides a practical way to spot the difference between capital needs of alternate proposals.

Warren Buell is chief economic analyst for the Union Oil Co. of California in Los Angeles.

WHAT TO INCLUDE

When a new undertaking is proposed, management must be given a good estimate of the total capital that's going to be required.

But determining this figure calls for more than just estimating the cost of all facilities and then adding an allowance for contingencies. You must also estimate the additional working capital needed to run the plant. How much money will be tied up in inventories of raw materials, semi-finished and finished products? How much credit will be extended to distributors?

There's no simple rule for determining working capital needs. They depend in large part on the nature of the project and on the operating and financial policies of your company. Yet with a little investigation you can quickly make an adequate estimate.

WHERE MONEY COMES FROM

To determine the cost of capital for a specific project you must first establish its source. And businesses get needed expansion money in various ways at widely divergent costs.

A recent study[1] indicates that corporations secure about 25 percent of their new capital through external financing —issue of stocks and bonds, borrowing from banks and insurance companies. Roughly 32 percent comes from profits earned but not distributed to the stockholders as dividends. Depreciation—funds set aside to replace worn-out or obsolete equipment—accounts for 24 percent. The balance comes from such short term sources as allowances for future taxes and other obligations.

Here's how to determine which source of expansion capital is best for your particular project:

Typical Money Costs Today

	Stated Rate	Before Taxes	After Taxes
	% per Yr.	% per Yr.	% per Yr.
Bonds	3	3	1.4
Bank loans	4	4	1.8
Preferred stock	4	9	4
Common stock	none	22	10

Should We Go to Outsiders?

External capital is money brought into a business from some outside source. And the cost of such money directly reflects the degree of risk taken by the supplier.

A relatively low interest rate is paid on bonds because bond interest has first claim on earnings—with few exceptions—and normal earnings are usually sufficient to cover this charge many times over. In the event of liquidation, the bondholder is reasonably sure of recovering his investment since the liquidation value of a company's net assets generally exceeds its outstanding bonds.

The holder of preferred stock receives a somewhat higher rate to compensate him for greater risk. He is paid a stated dividend and in a sound, well-managed business his income is nearly as secure as that of a bondholder.

The holder of common stock, on the other hand, accepts all the risks inherent in owning a business. His income is not assured, but may fluctuate greatly in response to changes in economic conditions. If the company fails, he may lose his entire investment. Naturally he receives a substantially greater return to compensate him for this greater risk.

RATES VARY GREATLY

The above table shows recent typical interest rates paid for capital from various external sources. These are applicable to well-established, dependable corporations. A new business, or one in a less secure financial condition, would have to pay more in each category.

Earnings on common stock, which vary from year to year, have averaged the above rates during the last few years. This source of capital will be discussed more fully in a separate section.

At present high rates, income taxes assert a significant influence on the cost of all capital. It's important to note that, from a tax standpoint, bond interest and stock earnings fall on opposite sides of the fence. The average corporate income tax rate today is about 54 percent (federal and state combined). This is paid on net earnings, which represent the difference between total income and total, pre-tax expense.

Because of this tax effect, every dollar of expense has a true cost of only 46 cents after taxes. And since interest is considered an expense for tax purposes, a stated bond interest of 3 percent per year is really equivalent to only 1.4 percent after taxes.

On the other hand, preferred stock dividends are not an obligation of the company, but must be paid out of net profit after taxes. They do not entitle the corporation to a tax credit. A preferred dividend of 4 percent, then, represents a rate of almost 9 percent before taxes. The same principle applies, of course, to common stock earnings and dividends.

You can see, therefore, that borrowed capital is cheaper and equity capital more expensive than is indicated by the stated rates.

YOU CAN'T ALWAYS CHOOSE

It's unrealistic to assume that every new project will be financed by borrowing new capital at a low interest rate. While this would be the least costly way, there are many factors that limit the amount of money you can obtain in this manner.

One is every corporation's need to maintain a balanced capital structure. Another is the hesitance of management to saddle its business with a heavy burden of fixed charges that might be troublesome during periods of low earnings. And there is not always unlimited capital available for borrowing at really attractive rates.

COMMON STOCK A PROBLEM

There is no problem in establishing the cost of most external capital. When money is obtained by bank loan, bond issue or issue of preferred stock, your cost is simply the stated rate, adjusted for the effects of income taxes if necessary.

But when additional capital comes from the sale of common stock, determining the cost of the money presents some complexities.

The most reasonable approach to the problem is from the standpoint of your existing stockholders. After new stock has been issued and the proceeds invested, the old stockholders must, as a minimum, continue to earn as great a return as they did before the new stock was in existence. And if this is to be so, the new capital must earn at least the rate of return earned by the old stock.

Failure to do this, of course, would result in lower earnings for the old stockholders. As far as existing common shareholders are concerned, therefore, the cost of such new capital is the present rate of common stock earnings. To determine this rate you must first measure the earnings attributable to the outstanding common stock, and second, the total investment of the common stockholders.

The earnings for any given year are the net profits for that year. If dividends are paid on preferred stock, that amount must be deducted from net profit to arrive at the profit earned on the common shares.

It should be noted, though, that dividends paid on common stock do not directly measure the earnings of that stock. Most corporations pay out only a portion of net profit as dividends. The balance is plowed back into the business and, in effect, increases the value of the common stock.

WATCH YOUR STEP

There are several pitfalls to be avoided in measuring the common stockholders' investment. It is not the aggregate par value of the common stock outstanding. Nor is it the net book value of this stock. Rather, it's the number of shares outstanding multiplied by the current price per share.

Current market price is the only true measure of the individual stockholder's investment, for it measures the amount of money he can realize immediately if he wants to terminate his participation in the company by selling his stock.

FIGURE THE STOCK EARNINGS

Common stock earnings rates can easily be calculated from the financial statement of your company. The figure at right shows a typical simplified balance sheet and income statement of a hypothetical firm.

Earnings on the common shares are the net profit—$260,000—less preferred stock dividends—$20,000—or a net of $240,000. From the newspaper financial page we learn that common shares in the company are quoted at $25. The aggregate market price of the 100,000 shares, then, is $2,500,000. Therefore the earnings rate on common stock for the year was 9.6 percent.

But it's not advisable to use a rate based on only one year's operations. In order to minimize the effect of business fluctuations, net earnings should be averaged over a longer period—five to ten years. And care must be taken to exclude years of unusually high or low earnings caused by nonrecurring effects, such as sale of real estate or a serious fire.

Also, if the number of outstanding shares has changed during this period, earnings will have to be adjusted accordingly. In any case, the current market price of the stock—not a past average—must be used to measure the common stockholders' investment.

The validity of this method can best be shown by an example. Considering the XYZ Chemical Co., let's suppose that management has decided to secure needed capital by issuing 20,000 shares of new common stock. Sale of these shares at the current market price of $25 will yield $500,000 in new money.

Let's assume further that the ten-year average net profit per common share is $2.50—10 percent per year on today's market price. The average earnings for the 100,000 outstanding shares of common stock is $250,000 per year.

But after issue of the new stock there will be 120,000 shares outstanding and earnings must jump to $300,000 per year to maintain the average rate of $2.50 per share. An additional $50,000 per year—10 percent of the new capital—must be earned to assure your old stockholders of the same earnings per share.

From the standpoint of existing stockholders, then, the new capital will cost 10 percent per year after taxes.

Should We Spend Our Own?

It's already been established that the biggest source of expansion money comes from internal sources—chiefly depreciation funds and undistributed earnings. But don't think this money is free. Like external capital, internal funds have a definite time value although there's no generally accepted way of calculating it.

From one standpoint, you can regard retained earnings as an involuntary investment by the holders of common stock. In theory they are entitled to sufficient added earnings to increase their stocks' value by the amount withheld. On this basis, capital retained from earnings costs the same as money from new stock.[2]

But for a specific project, it's impossible to break down internal capital into depreciation reserves and retained earnings. Therefore, you must try to establish a cost for internal capital that doesn't require source identification.

One common practice is to charge this capital with a

XYZ Chemical Company

Year ending Dec. 31, 1953

Assets		**$3,360,000**
Cash and receivables		$310,000
Inventories		650,000
Plant and equipment		
Cost:		$4,200,000
Less: depreciation fund		1,800,000
Net plant and equipment		2,400,000
Net assets		$3,360,000
Liabilities		**$580,000**
Current liabilities		$280,000
Funded debt: 3% bonds		300,000
Total liabilities		$580,000
Net Worth		**$2,780,000**
Stock:		
100,000 Common @ $10		$1,000,000
5,000 4% Preferred @ $100		500,000
Earned surplus		1,280,000
Total net worth		$2,780,000
Liabilities plus Net Worth		**$3,360,000**
Net Profit		**$260,000**
Sales		$3,000,000
Operating expenses	$2,080,000	
Depreciation	340,000	
Interest paid	10,000	
Income taxes	310,000	
Total expenses		$2,740,000
Net profit		$260,000

relatively low interest rate on the theory that it could be used to pay off funded debt—thus saving bond interest—or that it could otherwise be put into riskless, low-return investments, such as government bonds.

While this does provide a minimum charge, it's not entirely realistic. Liquidation of funded debt before it falls due is not usually considered to be an alternative to investing in improved facilities. Nor does smart management allow any great part of its capital to remain for long in low-interest investments.

A sounder approach is to assign this capital an interest rate equal to the company's return on all its capital. This, in effect, requires a new investment to earn at least at the same rate as the average existing investment. If you don't require this minimum, your company's earnings rate will shrink.

When you use this system, take care that the recipients of your economic study are aware of its implications. Any proposal that shows a breakeven with this type of interest will be at least as profitable as the average operations of the company.

FIND EARNINGS ON TOTAL CAPITAL

Your company's financial statements can also be used to determine the average earnings rate on total capital by making a simple adjustment to combine stockholders' equity and borrowed capital. The total capital invested in our hypothetical company is:

Net worth	$2,780,000
Plus: Funded debt	300,000
Total capital	$3,080,000

To determine combined earnings, you must add net profit and the bond interest paid. Also, since paying bond interest resulted in a tax credit of $5,400—$10,000 × 54 percent—the effect of this must be removed. The combined net earnings on total capital then amount to:

Net profit	$260,000
Plus: Interest paid	10,000
Less: Tax credit	5,400
Earnings before interest	$264,600

The company's average rate of return on the total capital employed, therefore, was 8.6 percent after income taxes.

Two Ways to Apply Interest Charges to Your Project

Having picked the interest rate to be used, the next step is to apply it to your capital estimate in order to establish the interest cost of the project. Again, authorities differ as to the best procedure.

Bullinger[3] holds that interest cost should be calculated on initial investment. His reasoning is that decline in plant value is always accompanied by the recovery of an equivalent amount of capital through depreciation, thus maintaining the original investment intact. (See *Chem. Eng.*, Feb. 1954, p. 195.)

Grant,[4] on the other hand, maintains that interest charges should be computed on the average investment over the life of the project—roughly half the initial investment—on the basis that investment shrinks steadily as your plant depreciates.

I feel that this use of average investment more nearly approximates the conditions that exist in business practice. As a piece of equipment wears out or becomes obsolete, depreciation is written in order to recover the capital originally invested.

And although writing depreciation is a paper operation, the results are real. Funds withheld as depreciation reserves are, in practice, soon reinvested in new equipment which must be evaluated separately. Less frequently, of course, such funds are set aside in a separate bank account or sinking fund.

In any event, money so withdrawn and used is no longer involved in the project under consideration. Thus, if a piece of equipment costing $1,000 is depreciated on a straight-line basis over its life, the average investment will be approximately $500 and the amount recovered and invested in other projects will also be $500.

When equipment has a salvage value, this must also be accounted for in computing average investment. Both salvage value and working capital represent a constant investment for the entire life of the plant.

Be Careful of These Common Misconceptions About Interest

It's extremely important that you don't use interest charges as a lever to force a desired return on your investment. In some companies it is the practice to establish an arbitrary level of return to be met by all projects. This rate is then used as the capital charge in cost estimates.

Such a system tends to obscure the true cost of capital because it includes a substantial element of profit. When used to make estimates of new product costs, this method doesn't yield a cost at all, but a cost-plus-partial-profit.

Interest charges should not be set at an arbitrarily high level, either, in order to make your estimate more conservative. The purpose of any cost evaluation is to provide management with the closest possible estimate of a project. It is then management's problem to weigh the economic study, add in all intangibles and apply executive judgment.

Undue inflation of any of the items in an estimate under the guise of conservatism is both unwarranted and dangerous. It might easily show a desirable project in such an unfavorable light that it is rejected. Loss of potential profit through ultra-conservatism is certainly just as bad as loss of profit through over-optimism.

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Dust Collectors Tested in Field

- **Impartial A.E.C.-Harvard survey highlights on-the-job performance.**
- **Covers low voltage electrostatic precipitators and wet collectors.**
- **Gives you broader basis for proper unit selection and application.**

R. DENNIS, M. W. FIRST and L. SILVERMAN

A knowledge of performance characteristics is essential to the proper selection and application of dust collection equipment. Yet the performance data available to the engineer charged with such responsibilities has been limited in scope.

To remedy this situation the Air Cleaning Laboratory of Harvard University has conducted a general survey of commercial dust and fume collectors. Field test results on various types of dry inertial and cloth filter collectors were reported in *Chemical Engineering*, Feb. 1952, p. 196.

Now in this present article data are shown for several types of low-voltage electrostatic precipitators and wet collectors. These data cover:

- Air and dust handling capacity.
- Power requirements.
- Dust retention characteristics.
- Relationship between influent and effluent dust loadings as governed by variations in concentration and size distribution of typical industrial dusts.

Low-voltage electrostatic precipitators tested ranged in capacity from 1,800 to 27,000 cfm.; wet collectors from 1,000 to 28,000 cfm. In general, wet scrubbers were used to collect relatively coarse dust, 20 to 140 micron mass median diameter; low-voltage electrostatic precipitators were removing atmospheric dust with less than 1 micron mass median diameter.

THESE ARE COLLECTORS STUDIED

Electrostatic precipitators were low-voltage, two-stage units used primarily for air conditioning systems. Operating principles and general design of all models tested were basically the same.

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Ionizing wires, maintained at a positive potential of 12 to 13.5 kv., immediately preceded collection plates having a 6 to 6.5 kv. charge. Plate depth in the direction of air flow varied from 10 to 12 in. Spacing between alternately charged and grounded plates was ¾ in.

Collectors differed in method of cleaning used, use of adhesive coatings and in location and construction of auxiliary filters. After-filters were employed on all units to guard against blow-off due to power failure and to eliminate carry-over during cleaning.

With one exception collector plates were arranged vertically on all tests. During test 7 the plates were positioned horizontally at a 60 deg. angle to air flow.

Two main types of wet collectors were investigated. One was the mechanical-centrifugal type fitted with 20 to 90 psi. water sprays. These units function both as dust separators and exhausters. The other consisted of non-mechanical inertial collectors with water sprays or wetted baffles. Here air flow depends upon use of separately driven exhausters.

Mechanical-centrifugal dust units studied fall into two design groupings. Both employed an involute scroll as a precleaner. Entering air is deflected by the scroll through a 270 deg. turn before admission to the separator.

In the first design, used for tests 10-14, a high pressure water spray (80 to 90 psi.) was directed against the impeller. Water sprays also were utilized in the precleaner entry to provide a wetted impingment surface.

The second design, employed for test 15, had precleaner and exhauster scrolls slotted to facilitate sludge removal. Several concurrent water sprays (3 to 5 psi.) were arranged along centerline of precleaner inlet. Flooding nozzles (3 to 5 psi.) were mounted in the droplet eliminator through which flows the discharge.

Several designs of non-mechanical, inertial type wet collectors were investigated.

For tests 16 and 17 air was drawn into the units through a box-shaped chamber and made to pass between partially submerged fixed impellers. Entrained moisture was removed by eliminator plates preceeding the fan.

On test 18 collector was designed to pass air through a four-turn, helical spiral aligned on a horizontal axis. Walls were wet by impingement of the air stream against the water in the bottom of each spiral.

Units used on tests 19, 20, 21, 23 and 24 consisted of cylindrical towers having bottom tangential entries producing a cyclonic air motion. Guide vanes and impingement plates wetted by low pressure water sprays were provided.

A centrifugal scrubber with similar entry and tower shape was used for test 22. However, there were no guide vanes or baffles within the cylinder. Tangential, concurrent water sprays were located on the inner walls. These sprays were high pressure air-water atomizing jets equivalent to 400 psi. hydraulic nozzles.

HOW DATA WERE OBTAINED

Details of most field sampling and testing methods employed in this study were reported in the earlier article previously mentioned.

Inlet and outlet dust loadings exceeding 0.1 gr. per cu. ft. were sampled with Whatman paper thimbles (19 x 90 mm.) Hot gas was sampled with a thimble composed of glass cloth and glass fiber.[a] A high volume sampler[a] (40 to 60 cfm. capacity) served for collecting effluents having concentrations less than 0.1 gr. per cu. ft.

Glass impinger tubes were used for

dust collection where excessive moisture caused filter plugging. When dust was suspended in an air-steam mixture, two impinger tubes in series were placed in an ice bath and connected to a droplet eliminator, orifice flowmeter and pump.

Rinsings from the metal sampling probe were combined with impinger contents, evaporated, weighed and sized. Since the steam was condensed in the impinger tubes only saturated air at approximately 70 deg. F. and 23 in. Hg passed through flowmeter.

Capacity and air velocity measurements were determined by standard pitot-static, vane anemometer or Velometer traverses. Pressure losses were calculated from static pressures.

Particle size data were determined by screen analyses and light-field microscopic measurements. Optical system for microscope had a 90X oil-immersion objective, a 20X eyepiece and a Porton disk micrometer.

Membrane filters[4,5] for sampling light loadings in the concentration range of atmospheric dust (0.02 to 0.1 gr. per 1,000 cu. ft.) provided a direct method of slide preparation for microscopy. A 5 to 10 cu. ft. air sample left a uniform dust deposit.

A few drops of immersion oil, having the same refractive index as the filter, were placed on it. Since the oil made the filter transparent, the dust could be observed in its original airborne state.

The membrane filter could not be used for sizing typical industrial dust loadings since the deposit was too heavy. Therefore, with heavy loadings, representative samples of the dry material collected on fibrous filters were redispersed in xylol-Canada balsam mixture by customary methods.

WHAT TESTS SHOWED

Test data for low-voltage electrostatic precipitators indicated weight collection efficiencies, against atmospheric dusts, ranging from 70.8 to 96.6 percent. These efficiencies refer, of course, only to tests where there were no apparent operational faults. No significant performance variations were observed among the three models studied.

Tests 1 to 3 and 5 to 7 indicated that efficiency varied inversely with face velocity. These variations were in the order of magnitude stated by the manufacturers; 90 percent efficient at 350 fpm. and 80 percent efficient at 400 fpm. according to filter stain or discoloration method.

Air velocities showed considerable variation over the face areas on tests 1 to 7 due to the location of return air ducts. In some instances the maximum velocities were nearly twice the average face velocities.

Particle size data for entering air were in general agreement with the usual atmospheric dust values. Averages of count and mass median diameters for tests 1 to 9 were 0.45 and 0.67 microns, respectively, for inlet air; 0.41 and 0.51 microns for outlet air.

Pressure losses of 0.05 to 0.1 in. of water were characteristically low for all units.

Tests 4a and 4b compare the effect of dry and adhesive-coated plates for the same unit. Voltage fluctuations may have exaggerated the advantage of plate coating.

Wet collector tests disclosed some interesting comparisons. Inertial-type collectors showed a marked increase in efficiency when provided with water sprays and/or wetted impingment surfaces. Comparisons were made between wet and dry units having essentially the same size, velocity and separating forces.

Previous tests[3] on dry mechanical-centrifugal collectors indicated weight collection efficiencies from 56.3 to 88 percent. Recent data[7] with similar units handling coarse dusts (69 to 145

WET inertial and mechanical-centrifugal collector data assembled for a variety of coarse dust collection problems.

		Dust Description											
		Inlet			Outlet								
Test[1] and Unit[2]	Operation	Loading, Gr. per Cu. Ft.	Mass Median, Microns	Count Median, Microns	Loading, Gr. per Cu. Ft.	Mass Median, Microns	Count Median, Microns	Air Flow Rate (S.T.P.) Cfm.[3]	Water Flow Rate, Gpm.	Entry Velocity, Gpm.	Pressure Loss, In. of Water[3]	Collection Efficiency, Weight %	Over-all Dimensions LxWxH or DxH Ft[4]
10(E)	Castings	5.07	47	9.5	0.022	7.2	1.7	10,400	9	3,750	3.2	99.6	8.8x8.0x15.3
11(E)	cleaning by	0.75	40	10.5	0.0052	6.7	2.1	4,150	9	1,490	4.4	99.3	8.8x8.0x15.3
12(E)	metal shot &	5.98	47	5.4	0.045	6.0	1.6	10,000	14	2,500	3.0	99.2	10.2x9.6x17.8
13(E)	sandblast,	7.29	43	1.1	0.029	2.7	0.6	5,220	7.5	2,830	3.3	99.6	7.0x6.6x13.2
14(E)	& tumbling	1.12	45	——	0.031	——	——	5,440	7.5	3,080	4.2	97.2	7.0x6.6x13.2
15(F)	Flyash, cold resuspension	1.35	15	4.0	0.030	——	——	1,000	6.5	2,800	5.1	97.8	3x2.5x8
16(G)	Foundry tumbling	0.28	140	10.1	0.0025	9.0	2.4	10,100	3.2	3,370	2.6	99.1	8.2x8.1x16
17a(G)	Machine shop grinding	0.0114	37	21	0.001	7.8	4.4	28,000	2.2	2,800	2.9	91.2	19.6x8.1x18
17b(G)	Machine shop general air	0.0056	1.0[8]	0.6	0.002	——	——	28,000	2.2	2,800	2.9	64.5	19.6x8.1x18
18(H)	Steam drying Al_2O_3	0.525	25	1.0	0.126	10.7	0.9	3,350 (176–140°)[6]	0.3	3,350	1.9	76.0	9x3x8.5
19a(I)	SiC	0.076	20	7.6	0.0024	5.0	3.1	895 (142–88°)[6]	4.5	1,350	0.7	96.8	3x13
19b(I)		0.127	——	——	0.0066	——	——	1,900	4.5	2,880	3.2	94.8	3x13
20(J)	Stone and sand drying	5.8	4.2	1.7	1.5	1.2	0.6	9,200 (230–120°)[6]	20	1,300	2.5	74.0	6x16.7
21(J)	Banbury mixer	0.0052	——	——	0.00077	——	——	16,000	16	3,200	5.2	85.2	5.3x13.5
22(K)	Ferro silicon furnace fume 90% amorphous silica	0.972	0.89	0.35	0.243	0.82	0.31	2,890 (329–72°)	10	4,000	1.1	75.0	4x16
23(L)	Sand and	3.6	4.3	1.7	0.3	1.2	0.59	3,200	10	2,050	——	92	3x19.5
24(L)	stone drying	6.4	——	——	1.7	——	——	10,000	12	2,000	——	73	4.5x18

[1] Letters in parenthesis indicate various designs. (E, F) mechanical-centrifugal types with moderate to high pressure water-sprays; (G, H) inertial types, dust collection by mixing with water in fixed impellers or channels; (I, J, L) cylindrical towers, tangential entries, with vanes, baffling and low to moderate pressure water-sprays; (K) cylindrical tower, tangential entry, no vanes or baffles, tangential concurrent air-water atomizing jets. [2] S.T.P. = 70 deg. F and 760 mm. Hg. [3] Inlet static pressure only for tests 10(E) through 17b(G). [4] LxWxH = length x width x height, DxH = diameter x height. [5] Estimated size, machining operations suspended during test. [6] Inlet and outlet air temperature, deg. F.

ELECTROSTATIC dust collector data cover various methods of plate cleaning, air flow and loading conditions.

Test[1] and Unit[2]	Method of Plate Cleaning and Coating[2]	Dust Description — Inlet — Loading, Gr. per 1,000 cu. ft.[3]	Inlet — Count Median, Microns	Inlet — Mass Median, Microns	Outlet — Loading, Gr. per 1,000 cu. ft.[4]	Outlet — Count Median, Microns	Outlet — Mass Median, Microns	Air Flow Rate, (S.T.P.) Cfm.[5]	Face Velocity (Average), Fpm.	% Air Recirculated, Estimate	Eff., Wt. %
1(A)	Manual	0.0254	0.44	0.90	0.00638	0.39	0.48	21,900	780	50	74.9
2(A)	washing	0.031	——	——	0.0034	——	——	15,700	154	65	89.4
3(A)	and	0.0302	0.44	0.85	0.00803	0.40	0.46	27,150	565	50	76.4
4a(A)[8]	water	0.0224	——	——	0.011	——	——	15,700	253[7]	50	50.9
4b(A)	soluble adhesive	0.061	0.45	0.74	0.0221	0.39	0.47	15,700	253[7]	50	63.7
5(B)	Automatic	0.0632	0.45	0.52	0.0058	0.42	0.48	4,580	255	50	90.9
6(B)	cleaning	0.0584	0.44	0.54	0.0171	0.42	0.47	22,000	389	50	70.8
7(C)	by oil dipping	0.0307	0.43	0.58	0.00107	0.39	0.48	7,370	140	50	96.6
8(D)	Built-in water	0.0302	0.51	0.63	0.0032	0.46	0.56	1,800	322	45	89.5
9(D)	sprays, no adhesive	0.00902	0.42	0.62	0.00228	0.41	0.51	2,200	297[7]	90	74.7

[1] Cell voltages; ionizer 12–13.5 kv., plate 6–6.5 kv. [2] Total plate depth was 12 in. except for tests 5, 6 and 7 which were 10 in. [3] Outside air in tests 1 through 4 was precleaned with coarse fibrous glass filters. [4] Loading refers to concentration downstream of metal fiber blow-off filters, integral parts of tests 5 through 9. [5] S.T.P. are 70 deg. F., 760 mm. Hg. [6] Letters in parenthesis indicate different designs: (A) (D) fixed vertical plates, (B) vertical plates moving at 2 rev. per 24 hr., (C) horizontal plates moving at 2 rev. per 24 hr. [7] Voltage fluctuation during tests. Arcing on test 4, low plate current on test 9. [8] No adhesive on plate. Pressure losses across all units varied from 0.05 to 0.1 in. water.

mass median diameter) show an average efficiency of 84.5 percent and a range of 56.2 to 95.8 percent. Efficiencies for wet mechanical-centrifugal collectors on tests 10 to 15 averaged 98.8 percent and ranged from 97.2 to 99.6 percent.

It should be noted that the above wet collectors include precleaning sections that require water circulating systems. Therefore, initial and operating costs may exceed those of corresponding dry types.

Inertial-type collectors on tests 16 and 17 appeared to be nearly as efficient as mechanical-centrifugal units when applied to similar dusts. These particular inertial collectors rely on fixed impellers to produce an abrupt change in air direction while simultaneously throwing up a water curtain.

Against general plant air (1 micron mass median diameter), however, efficiency was 64.5 percent. Water consumption was about 80 percent lower than that for mechanical-centrifugal types in the same capacity range.

Unit on test 18 gave 76 percent collection efficiency. It had a four-turn spiral passage with the bottom of each turn filled with water. An air-steam mixture passing through this unit dropped only 36 deg. F. indicating that little mixing of water and air occurred in this collector.

By contrast on tests 20 and 22 temperature reductions between inlet and outlet were 230 to 120 and 329 to 72 deg. F. respectively. Here low (20 psi.) and high (400 psi.) pressure water sprays were employed. Where intimate contact between air and water is desired, it appears that high pressure sprays offer a decided advantage.

Various designs of scrubbing towers, tests 19 to 24, were from 73 to 96.9 percent efficient. Collector on test 22 with 75 percent efficiency could not be compared directly with the other scrubbing towers. It handled a much finer dust with 0.89 micron mass median diameter.

A qualitative inspection of the test data for low pressure scrubbing towers showed efficiency variations which were consistent with the observed variations in water flow, entry velocity and particle size.

WHAT THE TESTS MEAN

Low-voltage electrostatic precipitators can clean atomspheric air satisfactorily when it is uniformly distributed and has sufficiently low velocity through the unit. Under optimum conditions usual atmospheric dust concentrations (less than 0.1 gr. per 1,000 cu. ft. and less than 1.0 micron mass median diameter) may be reduced by as much as 80 to 90 percent by weight.

Wet mechanical-centrifugal collectors provide satisfactory removal of coarse, foundry-type dusts (mass median diameter of 45 microns, count median diameter of 10 microns).

Scrubbing towers using low pressure water sprays are from 70 to 90 percent efficient for the collection of dusts greater than 5 microns in diameter.

Temperature reduction of gases passing through wet collectors handling hot gases provides a good index of the efficacy of the spray contacting system.

Wet collector tests indicate over-all dust retention is related directly to dust particle size, water consumption and collector entry velocity; inversely to spray droplet diameter. High pressure sprays appear to be more effective than low pressure sprays or water curtains in over-all dust removal.

Accuracy of field testing does not compare to that of laboratory testing due to uncontrolled variations in operating conditions. Poor performance of some installations was the result of faulty operation or application. Thus test results discussed here should not be accepted as an absolute performance index.

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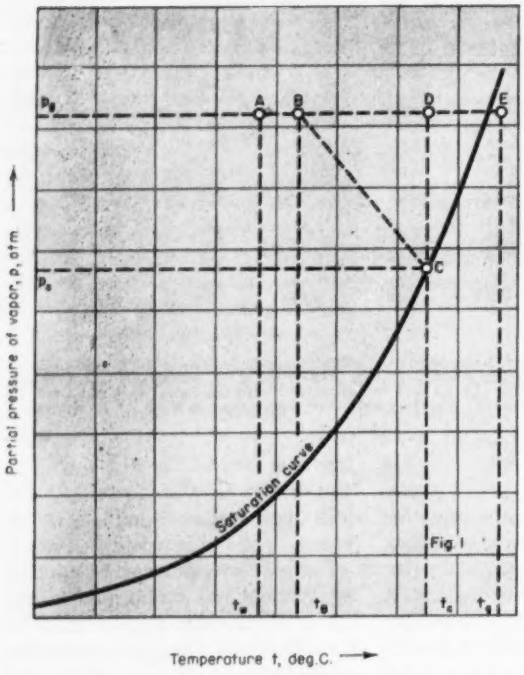

Fig. 1—p-t curve helps locate condensed liquid temperature.

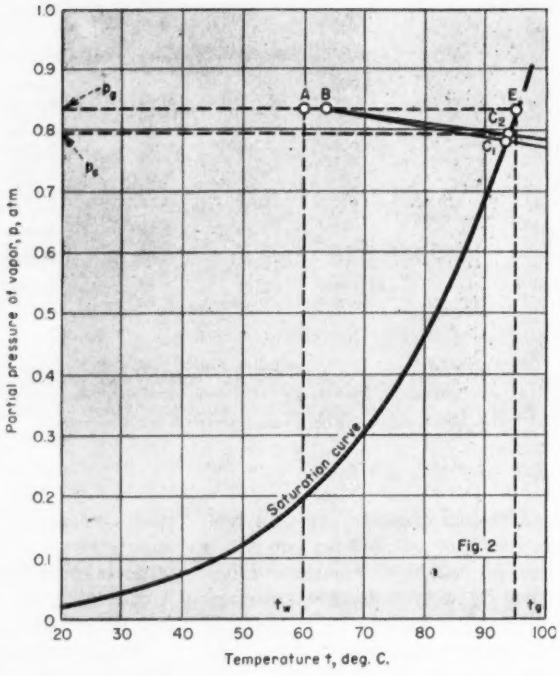

Fig. 2—Two trials locate correct condensed liquid temperature.

Shortcut to Cooler Condenser Design

If you design cooler condensers, then the author's improved design method introduced last year may already have helped you. Now this method has been further simplified and speeded up.

G. H. P. BRAS

Just a year ago (*Chem. Eng.*, p. 223 April and p. 238 May 1953) Mr. Bras introduced a new, largely graphical method for the design of cooler condensers for handling mixtures of non-condensible gases and saturated or non-saturated vapors. Now, a year later, he introduces an improvement of the original method which is faster and easier because it eliminates a great deal of the tedious cut-and-try of the original procedure.—EDITOR.

G. H. P. BRAS *is a chemical engineer formerly of Weert, Netherlands, and now with Chemical Construction (Inter-American) Ltd. in Toronto. He described the earlier version of this method in articles in our April and May 1953 issues.*

In 1934 Colburn and Hougen[1] gave a method for the design and calculation of cooler condensers. They showed that the gas-film and overall heat-transmission coefficients may vary widely in such apparatus. This is especially true when the total weight of the gas-vapor mixture changes greatly from the entrance to the outlet. Although several attempts have been made in the past to find a simple relationship expressing the average temperature difference between the gas mixture and the cooling water (for example, Haug and Mason,[2] Tymstra,[3] and others) all these methods are unsatisfactory when more exact solutions are required. Thus, Colburn and Hougen[1] proposed to calculate point-to-point values of $U\Delta t_{av}$, and to calculate the required condenser surface by graphical integration of the equation,

$$A = \int \frac{dq}{U\,\Delta t_{av}} \qquad (1)$$

Values of $U\Delta t_{av}$ can be obtained by the trial-and-error solution of the equation:

$$h_g(t_g - t_c) + k_g(p_g - p_c)\lambda = h_{comb}(t_c - t_w) = U\Delta t_{av} \qquad (2)$$

The values for the individual heat- and mass-transfer coefficients can be obtained from the literature, for example, from Chilton and Colburn's relations,[4]

$$h_g = \frac{jcG}{(c\mu/k)^{2/3}} \qquad (3)$$

$$k_g = \frac{jGM_v}{M_m p_{gf}(\mu/\rho D_v)^{2/3}} \qquad (4)$$

The heat transfer coefficient h_{comb} represents the combined value for the cooling water, tube, dirt and scale films, and the condensed liquid film. This coefficient is usually considered as nearly constant in cooler condenser design.

If the temperature and partial vapor pressure of the entering gas mixture are known, as well as the temperature of the leaving cooling water, Eq. (2) can be solved for t_c and p_c. This requires a tedious trial-and-error procedure, however. When the gas-vapor mixture enters saturated, and when it can be assumed that the mixture will remain saturated on its way through the cooler, the corresponding temperatures of the cooler water and that of the gas-vapor mixture can easily be calculated by a simple heat balance. This is the way it is done in the design method proposed by Colburn and Hougen.[3]

The latter method cannot be used if a non-saturated gas-vapor mixture enters the cooler condenser, or if it cannot be assumed that a saturated entering mixture will remain saturated during cooling. This was pointed out by the author a year ago[4]. Then a general method was presented for the design and calculation of cooler condensers and other equipment in which simultaneous heat- and mass-transfer occurs, as in cooling towers, humidifiers, dehumidifiers, dryers, etc. The new design method constructs the temperature-pressure path of the gas-vapor mixture in the cooler, by a graphical step-by-step procedure on the *t-p* diagram. It is done by using the theoretically derived equation:

$$\frac{dp}{dt} = \frac{\Delta p}{\Delta t} \cdot \frac{(P - p_g)}{p_{gf}} \cdot \left(\frac{c\rho D_v}{k}\right)^{2/3} \quad (5)$$

If one wants to include the correction for sensible heat transfer due to the transfer of sensible heat by diffusing vapor, the right side of Eq. (5) should be multiplied by the factor $(e^a - 1)/a$. This correction was originally proposed by Ackermann[5] where a (Ackermann's $-$ ε) is:

$$a = \frac{c_{pv}M_v}{cM_m} \cdot \left(\frac{c\rho D_v}{k}\right)^{2/3} \ln \frac{P - p_c}{P - p_g} \quad (6)$$

In using Ackermann's correction factor, Eq. (6), some authors have left out the first part of the left side of the equation, $c_{pv}M_v/cM_m$, which may cause confusion.[6] In deriving this equation from Ackermann's equations, use has been made of Eqs. (3) and (4), thus giving the exponent ⅔. For equipment in which turbulence promotors are used, for example, towers filled with packings, usually a somewhat lower exponent is preferred.

NEW GRAPHICAL SHORTCUT

Although by using Eq. (5), with or without corrections, we have a general method for designing cooler condensers, the tedious and time-consuming trial-and-error calculations for solving Eq. (2) from point to point cannot be avoided, as shown in the original publication.[4] The present paper's purpose is to present a new graphical procedure which greatly reduces the time required for the trial-and-error calculations. Chemical engineers who have designed cooler condensers by trial-and-error solution of Eq. (2) will know from experience that at least three to five trials are required before one hits the right conditions of temperature and partial vapor pressure in the liquid layer on the cooler tubes. In the method presented here, only one or at most two trials will be required to obtain the same result, as a later example will show.

Eq. (2) can be transformed to:

$$t_c - t_w = \frac{h_g(t_g - t_c)}{h_{comb}} + \frac{k_g\lambda}{h_{comb}} \cdot (p_g - p_c) \quad (7)$$

If we let $h_g/h_{comb} = R_h$ and $k_g\lambda/h_{comb} = R_m$ and note that:

$$t_g - t_c = (t_g - t_w) - (t_c - t_w) \quad (8)$$

then on rearranging we get:

$$t_c - t_w = \frac{R_h}{(R_h + 1)} \cdot (t_g - t_w) + \frac{R_m}{(R_h + 1)} \cdot (p_g - p_c) \quad (9)$$

Eq. (9) can be solved on a temperature-partial vapor pressure diagram (Fig. 1) if we write:

$$t_B = t_w + \frac{R_h}{R_h + 1} \cdot (t_g - t_w)$$

$$= t_c - \frac{R_m}{R_h + 1} \cdot (p_g - p_c) \quad (10)$$

In Fig. 1, Point *B* is found at the intersection of ordinate $p = p_g$, and abscissa $t_B = t_w + (t_g - t_w)\,[R_h/(R_h + 1)]$.

From Eq. (10) it follows that:

$$\frac{t_c - t_B}{p_g - p_c} = \frac{R_m}{R_h + 1} \quad (11)$$

In Fig. 1 $t_c - t_B = BD$, and $p_g - p_c = DC$. Thus, it is obvious that if we draw a line *BC* through point *B*, with a slope equal to $-(R_h + 1)/R_m$, the intersection of this line with the equilibrium line for saturated vapor will produce Point *C*, and thus the temperature and vapor pressure of

NOMENCLATURE

A	Surface area, sq. m.
a	$k_g\Delta pc_{pv}/h_g$, dimensionless.
c	Heat capacity of gas-vapor mixture, kcal./(kg., deg. C.)
c_{pv}	Heat capacity of vapor, kcal./(kg., deg. C.)
D_v	Diffusion coefficient, sq. m./hr.
G	Mass velocity of gas-vapor mixture, kg./(hr., sq. m.)
h_g	Heat transfer coefficient of gas film, kcal./(hr., sq. m., deg. C.)
h_{comb}	Combined heat transfer coefficient for cooling water, tube wall, dirt and scale films, and layer of condensed liquid, kcal./(hr., sq. m., deg. C.)
j	Heat- and mass-transfer factor, dimensionless.
K_g	Mass-transfer coefficient for gas-film, kmole/(hr., sq. m., atm.)
k_g	Mass- transfer coefficient for gas film, kg./(hr., sq. m., atm.)
k	Heat conductivity, kcal./(hr., sq. m., deg. C./m.)
M_v	Molecular weight of vapor.
M_m	Average molecular weight of gas-vapor mixture.
P	Total pressure, atm.
p_c	Partial vapor pressure at interface between gas film and condensed liquid, atm.
p_g	Partial vapor pressure in main body of mixture, atm.
p_{gf}	Logarithmic mean partial pressure of inert gases in gas film, atm.
Δp	Mass transfer driving force, atm.
q	Heat transferred, kcal./hr.
R_h	Ratio of heat transfer coefficients, h_g/h_{comb}.
R_m	Ratio of latent heat transfer coefficient in gas film, and combined heat transfer coefficient, $k_g\lambda/h_{comb}$.
t_c, t_g	Resp. temperature at interface between gas film and condensed liquid and temperature of main body of gas-vapor mixture, deg. C.
Δt	Heat transfer driving force through gas film, deg. C.
Δt_{ov}	Overall heat transfer driving force, between cooling water and main body of gas-vapor mixture, deg. C.
t_w	Temperature of cooling water, deg. C.
λ	Latent heat of condensation, kcal./kg.
μ	Viscosity, kg./(m., hr.)
ρ	Density, kg./cu. m.

the condensed liquid on the cooler tube.

Up to this point the method of finding the temperature and vapor pressure of the condensed liquid at the cooler tube (Point C), is straightforward, and no trial-and-error calculation is necessary. Unfortunately, in actual cooler condenser design the value of the mass transfer coefficient as calculated from Eq. (4) is often expressed in terms of the logarithmic mean pressure of the inerts p_{gf}. This remains unknown until the vapor pressure at Point C has been found. Therefore, we have to start the calculations by assuming a trial value for the temperature and vapor pressure of the condensed liquid, just as in the method of Colburn and Hougen. However, it will appear that the present graphical method of determining the conditions encountered at the condensed liquid greatly reduces the tedious trial-and-error work. Generally, one or two trials will produce the right answer, as the following example shows.

A DESIGN EXAMPLE

In a design example for a cooler condenser given by Colburn and Hougen,[1] a saturated air-water vapor mixture enters at 95 deg. C. Also $h_g = 34.5$, $K_g/p_{gf} = 4.88$, $h_{conn} = 310$, and the temperature of the leaving cooling water is 60 deg. C. The situation is represented in Fig. 2, where Point E represents the conditions in the gas-vapor mixture, and Point A is the intersection of the ordinate $p = p_g$, and the abscissa $t = t_w = 60$ deg. C.

A first trial with $t_c = 90$ deg. C., $p_c = 0.695$ atm., and $p_{gf} = 0.228$ atm. does not solve Eq. (2) because the left side of the equation amounts to 29,373, and the right side to 9,300. In the Colburn-Hougen paper[1] three other trials were required to produce the right answer at a value for $U\Delta t_m = 10{,}400$.

Applying the new graphical design method presented here, we find that:

$$R_h = \frac{h_g}{h_{conn}} = \frac{34.5}{310} = 0.1112$$

and

$$R_m = \frac{K_g M_v \lambda}{h_{conn}} = \frac{4.88 \times 18 \times 542.5}{310 \times p_{gf}} = \frac{153.5}{p_{gf}}$$

Trying $t_c = 90$ deg. C., $p_c = 0.695$ atm., $p_g = 0.835$ atm. and $p_{gf} = 0.228$ atm., gives $R_m = 153.5/0.228 = 673.0$. Also:

$$\frac{R_h}{R_h + 1} \cdot (t_g - t_w) = \frac{0.1112}{1.1112} \times 35 = 3.5$$

Thus (from Eq. 10) $t_g = 60 + 3.5 = 63.5$ deg. C., and Point B can be found on Fig. 2 at $p = p_g$, $t = t_g$. Finally,

$$\frac{R_m}{R_h + 1} = \frac{673}{1.1112} = 605$$

In Fig. 2 we now draw a line with a slope equal to $-1/605$ through Point B. The intersection of this line and the saturation curve gives a Point C_1 at $t_c = 93.4$, and $p_c = 0.785$ atm.

Substituting in Eq. (2): $34.5\ (95 - 93.4) + (4.88 \times 18 \times 542.5 \times 0.050/0.189) = 310 \times 33.4$ or $55 + 12{,}600 \neq 10{,}350$; although it is evident that the conditions at Point C do not satisfy Eq. (2), it is nevertheless remarkable that the right side of the equation already indicates the correct answer.

A second trial is then made with $t_c = 93.4$, $p_c = 0.785$, atm., $p_{gf} = 0.189$ atm., $p_g = 0.835$ atm., and $t_g = 95$ deg. C.

Then $R_m/(R_h + 1) = 153.5/0.189 \times 1.1112) = 731$. Drawing a straight line with a slope of $-1/731$ through Point B in Fig. 2 produces Point C_2 at the intersection with the saturation curve, where $t_c = 93.6$ deg. C., and $p_c = 0.794$ atm. This gives $p_{gf} = 0.1855$ atm. Substituting in Eq. (2): $34.5\ (95 - 93.6) + (4.88 \times 18 \times 542.5 \times 0.041/0.1855) = 310 \times 33.6$ or $48 + 10{,}530 = 10{,}400$, which is substantially correct.

SIGNIFICANCE OF METHOD

It can be seen that this method is straight-forward and would not require any trial-and-error calculations for the solution of Eq. (2) if the numerical value of k_g were known. This is often the case in calculations of this type, for example, in all those cases when the partial pressure is practically unity, or constant. However, if the mass transfer coefficient k_g is to be expressed in terms of p_{gf}, only one or two trial calculations will be required in using the method proposed here, against three to five in using the older method. The advantage of the graphical method is that the choice of (t_c, p_c) to be used in the next trial is no longer a matter of merely guessing. Each trial produces a greatly improved value of (t_c, p_c), and this value can be used in the next trial, which again produces a greatly improved value. So, one does not have to do as much guessing to hit the right value as in the older method.

The new design method is applicable not only to the design of cooler condensers, but also can be used with slight variations for the design of other equipment in which simultaneous heat- and mass-transfer occurs. These would include, for example, such equipment as dryers, humidifiers and cooling towers.

It will be understood that the graphical design method can be used in the same general way if one wants to use a heat transfer coefficient corrected for the effect of sensible heat transferred by the diffusing vapor, as originally proposed by Ackermann.[5]

The need to use a temperature-vapor pressure diagram and saturation curve does not increase the time required for carrying out the design calculations. Such a diagram must be available anyway if one wants to read partial vapor pressures at temperatures expressed in fractions of a degree, as required in this type calculation. Moreover, if equipment to be designed is to handle non-saturated gas-vapor mixtures, or saturated mixtures which cannot be expected to remain saturated, then a temperature-partial vapor pressure diagram will be needed in following the changes in temperature and vapor pressure of the mixture. This requires a graphical step-by-step procedure, as noted above and in the author's earlier article.[4]

Thus, it appears that the new graphical design method presented here is apt to speed up tedious trial-and-error calculations, or sometimes even to avoid such trial calculations entirely.

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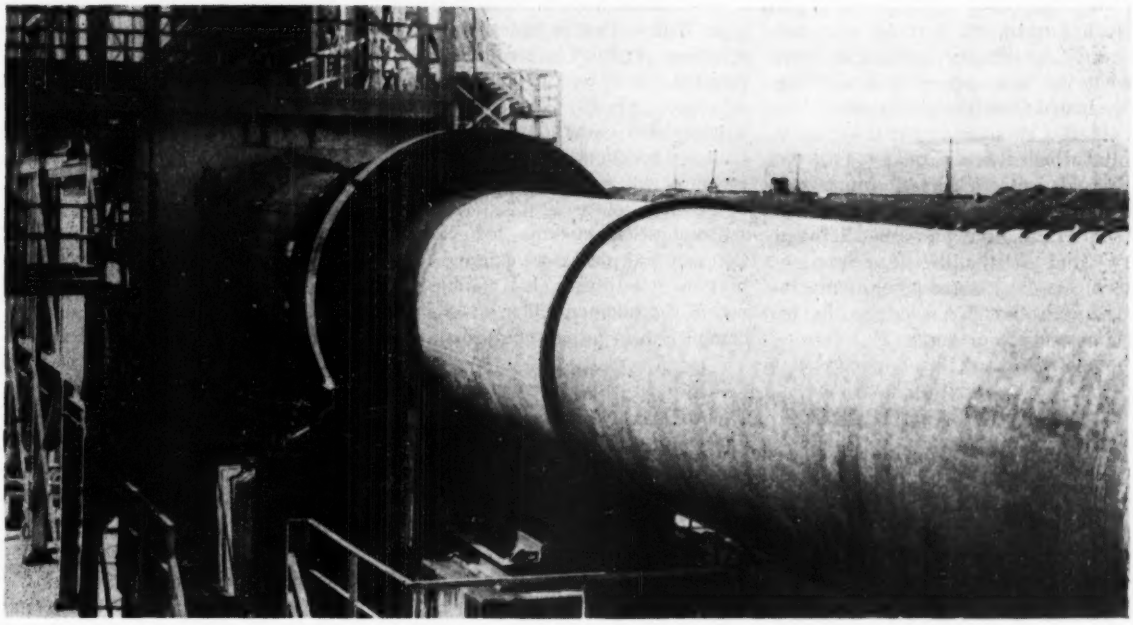

ROTARY KILN holds lead spot among U. S. calciners; can handle many materials when engineers understand . . .

How to Control Heat for Calciners

To get heat you burn fuel. But to harness this heat for effective calcining calls for some judicious engineering. Here are some practical views to guide your thinking.

WOLF G. BAUER

Calcination of minerals or other materials calls for either direct or indirect heating. Heat is transferred from burning fuels, heated gases or heated surfaces by conduction, convection and radiation.

In a material-heating process, calcination may be either an intermediate or final step. Often it is accompanied by drying, preheating and subsequent cooling in a more or less continuous sequence. Preheating and cooling frequently are carried out as an integral heat-recuperating phase of the calcining cycle.

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Heating for calcination may be analyzed as a two step process; a.) efficient utilization of fuels in the physical-chemical combustion step and b.) efficient application and control of the heat for process needs.

Economic use of fuels has been pushed to a high level by modern instrument and control systems for fuel and air regulation; improved technology of heat recuperation and insulation. By contrast creation of effective hot gas streams for process needs challenges the engineer to make further improvements.

Peak efficiency on both steps is of prime interest. Process or equipment limitations may prevent realization of this goal on both steps concurrently.

During calcination heat is absorbed throughout a considerable range of temperatures, varying with the material and purpose of heating. For example, in the low temperature range gypsum has two dissociation levels, 250 and 450 deg. F. Or in the higher temperature range bauxite or clays may be calcined at two different levels; at 1,000 deg. F. chemically combined water or organic matter are driven off while elevation to 2,500 deg. F preshrinks the clay.

Invariably, when dissociation of the mineral or compound is involved calcination is an endothermic process. For this reason considerable temperature differential can be tolerated between heat source and material. Amount of energy or heat absorption varies with the material.

Mechanism of dissociation is related directly to particle size and density. A calcining particle acts somewhat like a sponge with heat being conducted from the surface inward.

Heat is absorbed by the dissociation front which slowly shrinks toward the particle center. Material inside this front has not yet reached dissociation temperature and pressure. Between the front and the particle surface material is above dissociation temperature even though cooled by the reaction and escaping gases.

With these facts in mind it is obvious that so long as endothermic absorption prevails considerable temperature differential can be maintained as a driving force. Once dissociation is completed endothermic absorption ceases to function. Then particle temperature will rise and approach that of the heat source.

Combustion systems for calcination may provide for a.) external combustion in a furnace, b.) combustion within the calciner, and c.) two stage combustion in furnace and calciner.

With Heat Generated Externally . . .

Operator has wide range of control for calcining.

Heat from external furnaces is carried to the calciner in combustion gas diluted with excess air or recycled waste or exhaust gas. Recycle is used for lowering temperature, controlling volume, velocity or composition of the gas.

". . . . efficiency of external combustion chambers is not limited by design of the calciner."

External combustion chambers are completely free of limitations imposed by calciner design. Thus they can be designed to satisfy fuel and heat requirements. On the debit side they suffer greater heat losses, are limited in using all recuperated heat in combustion air and usually cost more.

Furnace efficiency should be analyzedon an over-all basis. Major factors to be considered are fuel, power, maintenance and repair, attending labor and depreciation. By comparison, combustion efficiency is concerned directly with generation of heat in relation to its use. This centers around control of combustion at the burner or burner ports.

External furnaces and combustion chambers must include a gas conditioning climate to produce any degree of oxidizing, reducing or neutral atmosphere; any combination of gas volume, pressure, velocity, luminosity and gas flow direction.

In use of low temperature heating gases, transfer of heat is mainly by convection. This calls for clean gas in large volume or with high velocity and turbulency.

It is, therefore, mandatory that combustion take place at efficient high temperature conditions. In fact, the lower the temperature of the required heating gas, the higher should be the initial burning temperature during combustion. Combustion products then can be conditioned by mixing with excess air or waste gases.

High flame temperatures are attained with near-theoretical air-fuel mixing ratios and high mixing velocities in special refractory high reradiation combustion muffles. Such ignition and combustion refractory surfaces can be air-cooled with radiant-heat recuperating air over the furnace surface.

With combustion rates up to or exceeding a million Btu./cu.ft./hr. using oil or gas, the short, clear, nonluminous flames are handled as high velocity gases. There are no further problems in secondary combustion, sooting due to chilling, or radiant heat losses to surfaces outside.

Since the high temperature combustion process is completed in minimum space-time, conditioning of the stream of very hot products of combustion may be performed safely, cleanly and without overlap into the combustion zone. Here, jetted air streams for dispersing and mixing the hot gas stream, venturi diffusers and refractory flow-disturbing baffles are used to speed combustion and reduce space between firing chamber and calcining unit. In all cases it is of utmost importance that combustion zone and gas tempering zone do not overlap.

At times calcining processes require low temperature, soot-free heating gases or gases with carefully controlled oxygen and carbon monoxide content. For this purpose a recent development is an integral design of high velocity gas or oil burner and jet-turbine combustion chamber. (*Chem. Eng.*, Feb. 1953, p. 208.) It allows combusion rates up to 10 million Btu./cu. ft./hr. at near stoichiometric fuel-air ratios and near theoretical flame temperatures. This high level combustion needs only minimum furnace and combustion space. Most of the combustion space is within the burner itself.

". . . but such high rates of heat release are not possible with solid-fuel-bed furnaces."

Solid-fuel-bed furnaces cannot be operated at very high heat release rates because of ash fusion temperature limits. Upper rates seldom reach 75,000 Btu./cu. ft./hr.

Characteristics of fuels in this category critically influence firebox design and the handling of any secondary combustion. Considerable time and secondary combustion space must be allowed for burning all combustible gases, hydrocarbons, and any carbon monoxide.

Volatile combustible gases from certain bituminous coals, wood and cellulose wastes must be handled in a manner to avoid cracking and luminous soot formation. High temperature refractory surfaces are needed along the distillation zone or gas path. Excess air must be mixed in vigorously by refractory baffles, radiant arches or some other provision. High velocity air jets above the bed in the path of the flowing gases speed final combustion and mixing in minimum space.

Due to ash removal and fuel supply operations it is difficult to obtain heating gases at pressures of more than a few inches of water.

More efficient design and operation of the heat generating system are possible if solid fuels are pulverized and liquid fuels are atomized and gasified. Heat radiating refractory surfaces and combustion space can be designed to avoid impingement or eddy losses. Furnace or firebox can be sealed and put under pressure of several pounds.

". . . for higher temperatures the external furnace permits close control of gas composition."

Furnaces designed to supply high temperature gases to calcining units and processes should be close-coupled to the calcining system in order to minimize radiation and temperature losses. Use of separate external furnaces or fireboxes may be required for calcining materials in the medium temperature field up to 1,100 deg. C. Examples are where the direct flame contact and radiation may be too severe for the process, or where exceptionally close control over gas composition in the calcining zone is prerequisite.

When neutral or reducing conditions are to be maintained without soot or ash contamination, high temperature combustion can be provided in conjunction with recirculation of exhaust gases to reduce temperatures. In that case, the combustion chamber and burner is designed for high heat release. Re-cycled gas is mixed with combustion gas prior to introduction into the calciner.

In shaft type calciners products of combustion are introduced into the charge itself. Low temperature partial or two-stage combustion may be employed in order to prevent localized heat development within the calciner.

For rotary calciners use of hot gas streams in which all combustion has been completed makes it possible to introduce the gas with minimum turbulency and velocity. Thereby, dust pick-up is kept low with certain materials.

In cases where solid fuels burned on grates are the only economical source of heat available, external fireboxes must be used. Often it has become feasible to burn with air deficiency in the firebox. Secondary combustion is allowed to take place close to the calcining material. For such conditions burning of fuel in gas producers may also be indicated.

Combustion under pressure up to several pounds per sq. in. poses special problems in technique and combustion chamber design. Personal experience with fluidized solids calciners indicated that refractory settings had to be constructed particularly tight where the firing chamber was located directly below the fluidized bed. Metal baffles had to be extended partially into the brick walls to prevent short-circuiting of hot gases between the steel shell of the combustion chamber and the lining.

In view of the tight closures, explosion doors and glass sighting windows are recommended. Special burner cooling provisions are usually required, as well as pilot flames or electric spark flame failure devices.

Where secondary preheated air is supplied from a fluidized bed of material below the combustion chamber, it is necessary that there be no flame and dust impingement in the combustion space or on the bottom of the grid through which the hot gas must pass.

Premixing of secondary air in the combustion chamber need not be thorough or efficient. Extreme turbulency within the fluidized bed will combine all unburned gases with the available air flowing through the grids.

Gas and oil are the best fuels for use under pressure conditions. It is necessary only to maintain the same differential pressure through the burner as in application at atmospheric conditions. As little as 15 percent atomizing air has been used for such combustion with low pressure oil burners. For natural or liquid gas no primary air may be necessary if fullest heat recuperation from material cooling is to be realized.

On flash-calcining systems calcination takes place while small particles are in suspension, entrainment, or free fall under gravitational or centrifugal forces. Temperature of the heating gases is governed by the endothermic absorption capacity of the material, by the materials of construction of the calcining chamber, or by the heat resisting capacity of a grinding system.

When mechanical moisture removal precedes calcination, high temperature differentials between gas and material may be tolerated. Due to rapid chilling of the gas by the moist material it becomes necessary to complete all combustion prior to introduction of the gases into the calcination chamber.

With Combustion Inside Calciner . . .

Control can be varied to meet high temperature needs.

When materials are calcined above 1,000 deg. C. the fuel and air may be ignited and allowed to burn within or over a column or bed of material. The modern gas-fired shaft kiln, the mixed-feed shaft kiln, some fluidized bed calcining systems and most rotary kiln systems are examples of combustion taking place in contact with the material to be calcined.

Combustion, in mixed-feed shaft kilns, takes place within the charge in a narrow band or zone. By regulating fuel distribution in the charging zone combustion is controlled to give uniform temperature over the cross-sectional area. Excessive fuel concentration near the kiln walls causes fusion and sticking, uneven downtravel and calcination.

Depth of the firing or calcining zone is a function of fuel particle size and air flow rate. Ascending air and gases tend to short circuit along the shaft wall at the periphery of the charge. This often is controlled by feeding smaller-size ore to periphery.

Control is best exercised through periodic or continuous gas analyses taken at strategic locations in the kiln top and through the kiln lining at the combustion zone level. In conjunction with thermocouples, these analyses provide a picture of the width, attitude, location and uniformity of the combustion and calcining zone within the cylindrical kiln shaft.

Suitable fuel is that containing a minimum of volatile matter such as coke and anthracite coal. Volatile fractions would be driven off and ignited high up in the preheating zone and their fuel value lost for calcining purposes. The resulting misplaced heat and contamination would be detrimental to equipment and exhaust gas usage.

Fuel also should be low in ash for minimum product contamination. Ash should be of high refractoriness, if possible.

Control of fuel-air balances is essential to efficient operation. Draft gages measure air flow under suction

or pressure in the kiln-cooler inlet duct. Fuel can be measured by volume or weight during the charging operation.

Modern high capacity shaft kilns fired by natural or producer gas are used almost exclusively for calcination of dolomite and limestone. Also certain clays and phosphate ores have been calcined in such kilns. Combustion is very efficient from a thermal standpoint, as the shaft kiln represents a true counterflow system.

Gas is introduced into the kiln either centrally or from the sides through refractory ducts or ports. It mingles with preheated air rising from the cooling section below. Subsequent mixing and combustion of air and gases takes place within the interstices of the particles filling the shaft.

Recycled exhaust gas can be used to control heat distribution and prevent localized overheating near the gas ports. It can be mixed with feed gas or co-introduced through separate adjacent ports.

This type of kiln is operated either under suction or pressure. The latter technique results in better heat distribution, but initial investment cost is somewhat higher.

Combustion in these kilns is at a high heat release rate. Contributing factors are confined and continually shifting combustion spaces, high air preheat, high degree of turbulency and possible catalytic surface combustion effects.

Under forced draft, heat release easily may reach 200,000 Btu./cu. ft./hr. This is considerably higher than obtained in rotary calcining kilns. If oil is used as fuel, it must be gasified to obtain uniform and effective distribution throughout the charge.

". . . rotary kilns are recognized as leading producers of calcined products."

Rotary kilns lead all other calciners on a basis of tonnage of material processed. In the United States they also find the widest adaptation to various calcining processes, conditions, materials and fuels.

It already has been pointed out that when calcining temperatures are low rotary kilns are heated with products of combustion produced in external furnaces and fireboxes. Where natural gas is the obtainable economic fuel, it can be burned within the kiln in low temperature processes. However, for more efficient utilization it should be burned in a higher temperature separate furnace close-coupled to the kiln.

Oil and coal require separate hot fireboxes, radiant ignition-promoting surfaces near the flame origin in order to maintain a stable flame near the burner nozzle. These fuels are, therefore, suited particularly to higher temperature calcination requirements where radiation from refractory lining and material support combustion in the high velocity fuel-air streams.

". . . calcining factors are many and varied; charting of fundamentals is incomplete."

What are the factors that influence efficiency of heat production in relation to calcining needs? They are variables such as rotary kiln diameters, material loads, heat release rates, flame lengths and shape, flow pattern of secondary air entering the kiln, dust loading of the combustion air, and location as well as direction of fuel-air stream in relation to kiln axis.

To date there has been little agreement on the part of producers and engineers as to how these variables can be brought into a definite relationship with the process or fuel. Design of the kiln and components has been dictated by standard practice and material flow rather than gas flow and combustion considerations.

A wide field of fundamental investigations awaits the concerted effort of operators and specialists. Much can be learned by analyzing hundreds of installations and operating procedures. Because such a study has not been made this discussion is based entirely on empirical relationships and operating experience.

Rotary kilns generally are fired with a single large burner thrust through the firing hood and extending up to or past the kiln opening. When planetary multi-coolers are used, the burner barrel must extend the nozzle into the kiln up to the material discharge openings in the lining through which the preheated secondary combustion air enters the kiln.

Burner is located usually centrally and parallel to the kiln axis although there are variations to this placement. There are also frequent instances in which more than one burner is mounted at the firing hood. Such installations have been applied to both high and low temperature calcination. The problem of establishing a suitable temperature profile throughout the kiln length for a particular material is intimately related to combustion technique and burner application.

Flow of gas and air, in the combustion zone of a rotary kiln, is dependent on the flow pattern of air as it enters the kiln opening, and on the flow character of the fuel or fuel-air stream into the kiln opening. These flow patterns are a function of gas stream velocities, changes in velocity and whether the stream is under suction or pressure.

They are further modified by design and location of the hot air passages from the cooler, shape of the firing hood space, absence or presence of constricting dams or rings at the kiln opening and relative amount of air that is fed into the kiln under pressure through or around the burner.

Observations with many installations have shown that, in general, as the burner nozzle penetrates beyond the kiln opening it produces a smoother and more stable flame. Nozzles that terminate short of the kiln opening may allow the flame and ignition zone of the flame to be in a turbulent cross current of the uprising secondary air. This may produce unstable flame conditions, especially if the air passage from the cooler is restricted and the air rises at high velocity or under positive pressure.

Air passage area leading from the cooler often is dictated by oversize material that must be allowed to pass down through. It may be kept maximum for low velocity air and minimum dust pick-up or for reasons of minimum pressure loss affecting the draft-producing system.

". . . relative entrance paths of air and gas streams determine type of atmosphere produced."

If reducing conditions are required over the calcining material, the flame

should be directed low over the solids. The main secondary stream of hot air from the cooler can be forced to the top of the firing hood before deflection into the kiln.

Reversing the relative positions of flame and air stream provides oxidizing action and cooling effect. Burner and flame are high; secondary air is pulled sharply over the bottom lip of the kiln opening by a strong kiln draft.

The inducing effect of the high velocity fuel stream acting as a jet pump is very minor. Its efficiency as such is below 5 percent when computed under ideal conditions.

On the other hand, hood pressures at the kiln axis level are often neutral. Thus the position of such a nozzle ejecting a large volume air-fuel stream at high velocity can easily affect hood pressure.

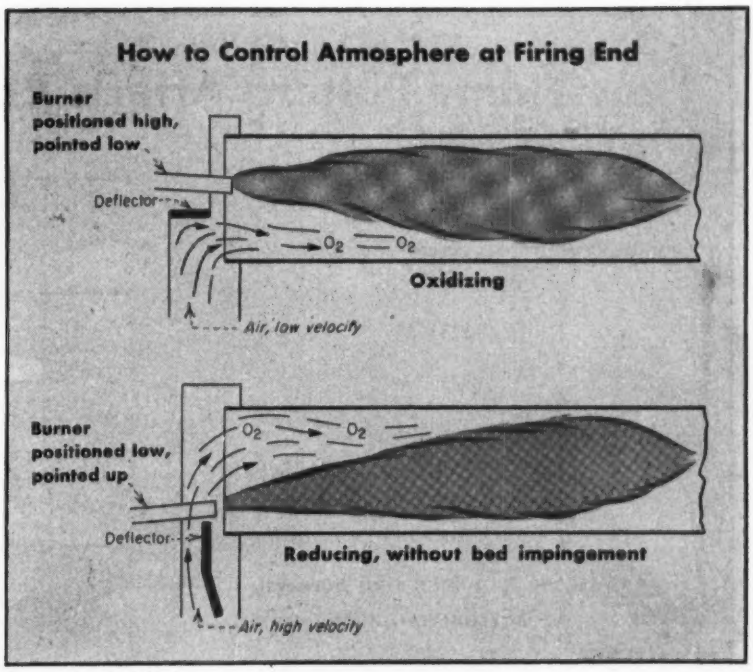
A nozzle, positioned at the kiln opening, or slightly inside, will create slight induction or negative pressure; one at some distance outside may bring on pulsations and positive hood pressure.

If powdered coal were injected with 35 percent primary air the kiln would receive considerable pumping effect to supplement draft. By contrast, a similar kiln fired by a pressure-atomizing oil burner or pure natural gas burner would pull all combustion air through the suction cooler by draft power.

Flow of gases in rotary kilns is in the turbulent range. While we speak of gas stratification, this has no relation to laminar flow found below a Reynolds number of 3,000.

Stratification of gases in a rotary kiln is much more pronounced than commonly realized. While this is not particularly serious in the combustion zone, lack of gas mixing between the end of the preheating and the beginning of the calcining zone or even downstream from the end of visible combustion may cause considerable waste of unburned combustibles. Conversely, if perfect mixing of combustible and air were accomplished in the flame generating or combustion zone, temperatures would rise too high for most calcining requirements.

Kiln lining roughness, scale rings, refractory dams, and the nature of the bed itself all tend to cause more or less turbulency of the immediate contacting gas layers. At the same time the central stream can flow at higher rates than it would if the kiln were smooth.



Scale rings, as constrictions, exert some gas mixing effect. If gases carry unburned combustibles, the added turbulency, eddies and radiation from the ring promote secondary combustion and additional heat generation at that point. It is obvious that such a condition deteriorates rapidly into further ring build-up unless the scale can be melted down or shrunk by chilling through judicious control of the flame.

In calcining operations using direct-fired rotary kilns the material must be heated to the range of 1,000 to 1,400 deg. C. In every case there appears to be a relationship between efficiency of operation and efficiency of combustion which limits heat release rate and maximum temperature attained inside the kiln.

By and large, depth of bed varies directly as range of particle sizes. Also as calcining temperature approaches a fluxing condition heat release above the bed of material should be less intense.

Flame from a single burner is in the shape of a non-symmetrical double cone. Radiation, therefrom, is more or less maximum where the flame is widest and hottest; it decreases toward the ignition point and toward the tip end in the opposite direction.

At the same time, the bed of material receiving the radiation is uniform in width, although not in its ability to absorb radiant heat. Flame design is, therefore, a most important part of combustion engineering.

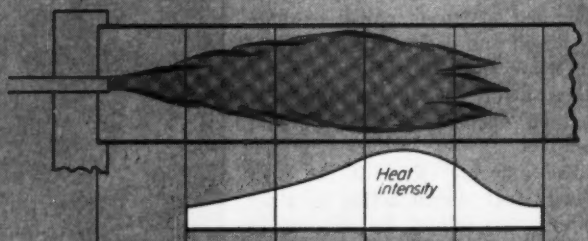
". . . forces of fluid momentum and combustion influence flame control within kiln."

For simplicity's sake it may be said that two mechanisms influence flame control within a rotary kiln: the fluid dynamics of projecting a jet of gas, gas-solid or gas-liquid emulsion into another gas flowing concurrently in a confined cylinder at a lower velocity; and the chemical and thermo-dynamic mechanism of gaseous diffusion, chain-reaction rapid oxidation and heat expansion of the flaming gases in the jet.

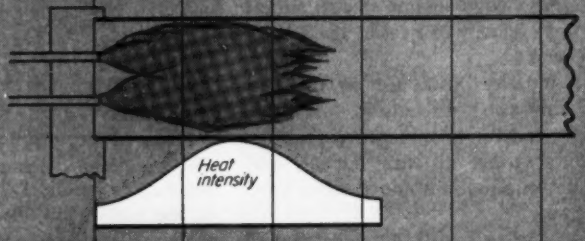
Since the jet is applied in a horizontal direction, gravitational force exerts a downward pull on any solid or liquid particles projected by the jet. Buoyant forces due to heat expansion

How Flame Pattern Affects Radiation Profile

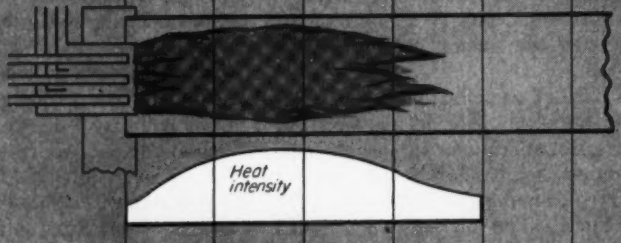
High speed single burner single cone impingement flame.



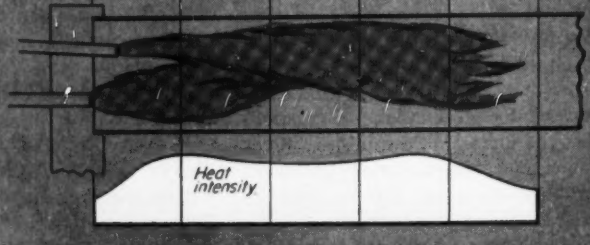
High speed or turbulent dual burners flame in parallel, concentrated intensity.



Low speed laminar multi-burner diffusion flame.



Compound flame dual burners reinforcing flame in series.



affect the gaseous stream in the opposite direction. Both forces are modified by the relative velocity of surrounding envelope of air being pulled horizontally through the kiln.

Uniform heat release over a length of kiln section calls for maintaining the width and temperature of the flame throughout its length. Obviously, this can be done only if the velocity and turbulency of the combustible stream remain constant.

Any jet stream from a burner nozzle is usually narrow with high velocity. Due to viscous drag, it is broken up increasingly by the forming of vortices and eddies at the interface toward the tip end. During this action stream velocity decreases and volume increases.

A combustible stream can be made to radiate heat uniformly between the ignition point and the flame tip. All fluids become turbulent under compression and deceleration; smooth under tension and acceleration.

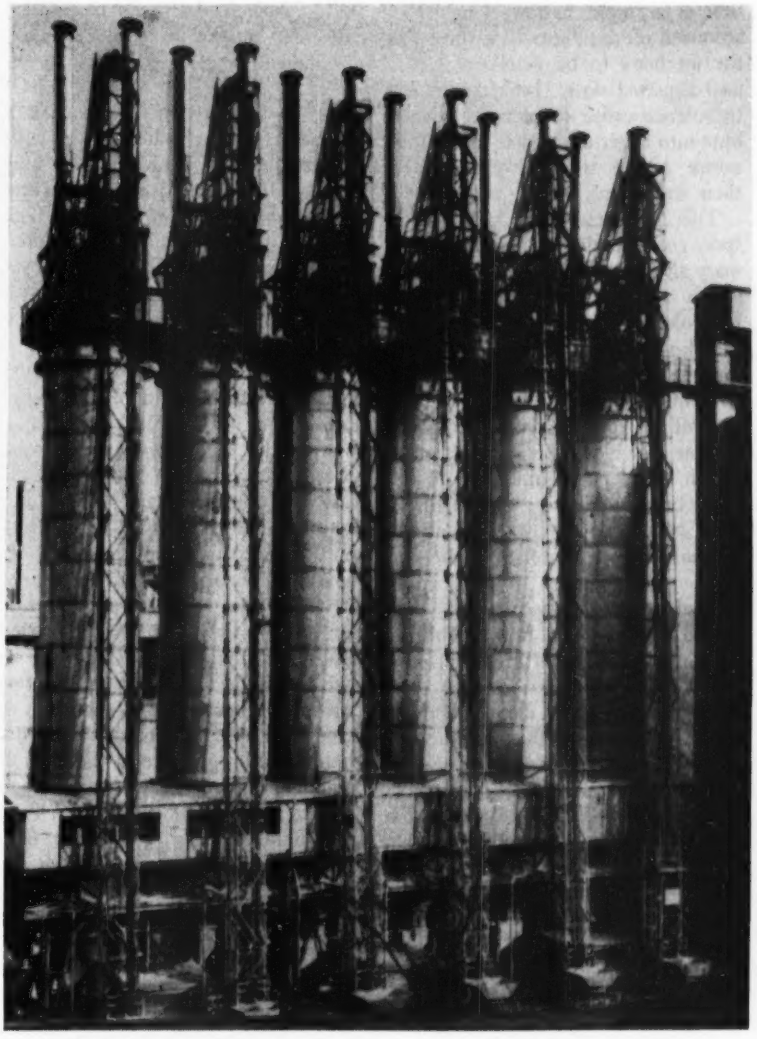
If the jet stream from the burner is introduced into a suitable cross-sectional area at the kiln opening its velocity will be near that of the surrounding air. Combustion then will be more by gaseous diffusion than by eddy and turbulent mixing.

Obviously this practice would be difficult to achieve with pulverized coal or atomized oil. With gases such as producer, blast furnace, carbon monoxide, butane, or natural gas, the streams would have to be neat or undiluted with air to prevent flashbacks at the low velocities.

Gas diffusion firing carried to this degree will result in lazy sheets and fingers of flame rather than a flame of definite shape. Combustion will be indefinite both in duration and heat release rate over the calcining material.

Neat-gas-stream velocity may be increased by decreasing the nozzle size. Flame will begin to assume a horizontal-cylindrical shape, more so at the nozzle and to a lesser degree near the tip where it will still break up into shreds and wisps across the kiln.

Further increase in velocity of the neat-gas stream will increase the turbulency, flame temperature and brightness of radiation. Flame length will decrease to a minimum beyond which higher jet velocity has no further effect on the flame length until blow-off velocity is reached at the nozzle.



SHAFT KILNS at Wuelfrat, Germany use only 3.25 million Btu. per ton of lime.

Such blow-off condition is a function of available ignition heat at the nozzle. Formation of fixed eddies behind nozzle flanges allows slow-speed gas to remain ignited for pilot combustion.

Despite the many intricate air-mixing gas burners being used it is advisable to consider the simple neat gas burner as a suitable approach to uniform low-temperature heat release. Such a burner allows maximum heat recuperation and cooling potential.

Radiant low-temperature flame firing is more difficult with suspended fuels such as coal, waste cellulose products, pitch, coke and atomized oil.

Oil may be atomized with low pressure air at one psi. differential through the burner using a minimum of 15 percent of total combustion air. Or it may be atomized by high oil pressure at high nozzle velocities without using air. Use of high pressure air or steam for atomizing is the more costly oil dispersion method.

Ordinarily, it is entirely possible to atomize oil into a fog-like hollow-cone spray and obtain what is essentially oil-gas firing. However, the projec-

tion of a single, narrow, long jet of atomized oil does not allow the oil in the jet body to be maintained in a well-dispersed state. Interference and turbulence cause droplets to re-combine into larger drops that will not vaporize before reaching the end of their trajectory.

This is especially true with narrow spray cone nozzles and minimum primary air. It is, therefore, necessary to supply a carrying medium of air or recirculated exhaust gas to support the droplets over the desired longer trajectory.

Flame can be lengthened by drawing hot air from the cooler through a cyclone and blower for re-injection as an air envelope around the oil jet. Coal burners likewise can be fitted with concentric jackets carrying air or inert exhaust gas for the same purpose.

Fuel streams or jets herein mentioned vary in form from cylindrical to conical; any departure from such a circular jet cross-section has a tendency to shorten the flame. The disrupting vortices at the jet boundary surface and diffusion of oxygen into the jet body hasten combustion by lessening the thickness of the jet body in one direction. Thus a flat sheetlike fuel stream does not have the carrying power of a circular stream with a full core of combustibles.

Diffusion burning and a long flame are not obtained necessarily by providing a secondary air envelope around the fuel or fuel-air stream issuing from the burner tip. This is because such an envelope or cylinder of projected air may be relatively thin and have high turbulent velocity, even when precautions have been taken for straightening and smoothing out the flow in the burner jacket.

In order to achieve an extremely mild, luminous, quiet diffusion-type flame of uniform heat release the combustible stream within an air envelope should have minimum velocity. Minimum velocity is limited by flame flash-back or propagation speed into the burner tube or nozzle at the lowest operating speed and Btu. input. For oil this may require atomization from a nozzle cluster in which three or more narrow-angle solid-spray nozzles produce fine atomization of the liquid.

". . . fuel characteristics are prime factors in type of burner stream obtained."

When secondary combustion air is admitted to the kiln through the cooler breeching, production of a long and more luminous flame is a matter of jet-mass projection, often at high velocity. There are essential differences between combustible streams of gas, atomized oil and pulverized coal. It is necessary to consider these differences at this point.

Gas streams issue from a burner nozzle or tube as combustible cylindrical cores of varying cross-section. They widen by turbulent dispersion after leaving the tip. This also is the case with pulverized solid fuel streams.

Oil is usually atomized from a single opening of small cross-section. The liquid fuel plus vaporized oil gas is spread out in a cone, frequently hollow. By the time this thin-walled and usually spinning oil spray and vapor has been bent back by the fast flowing primary or secondary air around it, the flaming gas plus unburned oil droplets are in the form of a hollow cylinder, easily disrupted and burned at high combustion rates. Thus the momentum or mass effect of a solid combustible stream core or jet, found in the case of coal or gas, is missing in oil flames. Use of nozzles producing solid cone narrow angle sprays, singly or in clusters, will materially aid in this problem of flame projection.

The high velocity narrow flame projected with minimum dispersion does not release its radiant heat near the nozzle or burner tip. In fact, the velocity of the issuing jet may be sufficient to hold the ignition point of the stream at some distance from the burner tip.

". . . secondary supporting flame overcomes uneven heat release from burning oil flame."

To offset this uneven heat release over the length of the flame and more nearly produce uniform radiation a second supporting flame is added parallel to the main flame and adjacent to the latter's narrow low radiation section.

This supporting flame introduces less than one third of the total fuel input. Its shape is broad and short. It may be either cylindrical or flat in body.

The burner producing this first section of the "compound" flame is designed to provide steady ignition at its nozzle. This is important since the nozzle is located closer to the hood front and more directly over the interfering air stream coming up from the cooler. Flame from this supporting burner may also act as a pilot flame for the faster flowing combustible stream of the main burner and starve the latter of early oxygen access from the cooler-air flow beneath it.

It should be obvious that the compound flame is not a dual flame such as would be produced by operating two burners side by side with flames in parallel arrangement. Rather, this compound flame is a two-component flame in series. The heat release along the flame path into the kiln is controllable at each end as well as in the middle by adjustments to each component flame. Thus it is possible to create a longer uniform flame which does not concentrate its heat within any particular short zone in the kiln. Such a compound flame also brings the hot radiating calcining section of a rotary kiln closer toward the discharge end for better control and kiln length utilization.

Long, low-temperature, luminous rotary kiln flames can be created in two ways. First, by using low velocity combustible streams of maximum cross section, carried into the kiln either with or without an adjustable envelope of air moving at similar speed. Second, by projection into the kiln of a dense and narrow high velocity fuel stream. Maximum carry as a narrow stream without early spreading or disruption depends upon momentum of the fuel particle. The first narrow and least radiant section is reinforced with a supporting primary flame of considerable width to create a stable and controllable compound flame.

Both types of flames have proven their merits in establishing suitable temperature profiles for the path of the calcining material. Also they provide more uniform rapid heat transfer, minimizing troubles with refractory lining and scaling.

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Chemical Engineering Fundamentals

Chemical Equilibrium—III

THOMAS E. CORRIGAN, Research Engineer, Mathieson Chemical Corp., Brandenburg, Ky.

The two previous installments on chemical equilibrium (*Chem. Eng.*, Mar. 1954, p. 222, and Apr. 1954, p. 212) were concerned with the energy effect accompanying a reaction and the significance of the equilibrium constant.

This third installment will deal almost entirely with the use of the equilibrium constant to find out how far a reaction will go. Both the isothermal and adiabatic cases will be discussed for homogeneous single reactions. We'll consider simultaneous homogeneous reactions also. In addition, for adiabatic reactions, we have outlined a short-cut graphical method for solving problems.

In a concluding installment on chemical equilibrium, a discussion of standard states will be featured.

Calculation of Equilibrium Conversion: Single Isothermal Reaction Between Ideal Gases

For practically all cases in engineering calculations, the evaluation of the equilibrium constant is merely a means to an end. The ultimate goal is the calculation of how far a reaction will proceed—the equilibrium conversion. One of the simplest cases of calculating equilibrium conversion is for an isothermal reaction involving ideal gases. Consider the reaction

$$A \rightleftarrows R + S$$

where A, R and S are ideal gases.

The first step is to calculate K. We usually use the method involving the standard heat of reaction and the standard enthalpy change because this data is available for most substances. In the tables that give standard heats of formation (or standard heats of combustion) and absolute entropies, the standard state is usually specified as unit fugacity for all gases (most often stated as the pure gas at 1 atm. pressure).

The calculation must be based on the standard state specified by these tables and is not arbitrary, as many people are led to believe. If the standard state for each component is that of unit fugacity, the equilibrium becomes

$$K = (p_R p_S)/p_A$$

It is necessary to express each partial pressure in terms of the same variable—degree of conversion. If the initial gas consists of 1 mole of A, we can express the equilibrium at conversion, x, as follows:

$$\begin{matrix} A & \rightleftarrows & R & + & S \\ (1-x) & & x & & x \end{matrix}$$

Constituent	Number of Moles	Mole Fraction	Partial Pressure
A	$1-x$	$(1-x)/(1+x)$	$\pi(1-x)/(1+x)$
R	x	$x/(1+x)$	$\pi x/(1+x)$
S	x	$x/(1+x)$	$\pi x/(1+x)$
Total	$1+x$		

Therefore the equilibrium equation becomes,

$$K = \frac{\pi[x/(1+x)]\pi[x/(1+x)]}{\pi[(1-x)/(1+x)]} = \frac{\pi x^2}{(1-x)(1+x)}$$

or,

$$K = \pi x^2/(1-x^2)$$

and

$$x = [K/(\pi + K)]^{1/2}$$

If in the above reaction the pressure were 1 atm. and K were equal to 1.0, then

$$x = [1/(1+1)]^{1/2} = (1/2)^{1/2} = 0.707$$

or there would be 70.7 percent conversion.

Correction for Non-Ideality

If the pressure is so high that the gases do not behave ideally, the equation would have to be corrected for non-ideal behavior. Since the standard states are still unit fugacity, the equilibrium equation would be:

$$K = f_R f_S / f_A = \nu_R p_R \nu_S p_S / \nu_A p_A$$

The fugacity coefficients, ν, would have to be evaluated. We included a generalized fugacity coefficient chart in the previous installment (*Chem. Eng.*, Apr. 1954, p. 216) which may be used for estimating these values.

In this case

$$K_\nu = \nu_R \nu_S / \nu_A$$

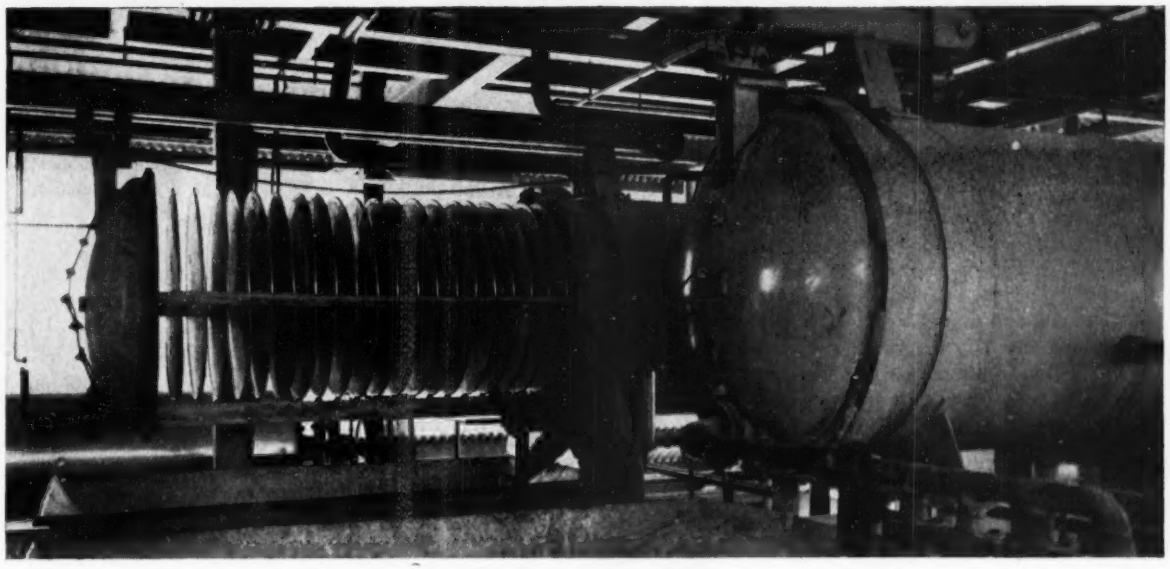
therefore the equation becomes,

$$K/K_\nu = p_R p_S / p_A$$

We can solve for the conversion as in the example above,

$$x = \left[\frac{K/K_\nu}{\pi + (K/K_\nu)}\right]^{1/2}$$

The only difference between the non-ideal case and the previous case is that the ratio K/K_ν replaces K in the equation for x.



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Equilibrium Conversion Problems

Problem—When cumene (isopropyl benzene, C_9H_{12}) is cracked over a standard cracking catalyst, it decomposes into benzene and propylene with practically no side or secondary reactions. The equation is:

$$C_9H_{12}\ (g) \rightleftarrows C_6H_6\ (g) + C_3H_6\ (g)$$

At 960 deg. F. the equilibrium constant for this reaction is 9.25. What is the equilibrium conversion of this reaction at 1 atm. pressure and at 6 atm.?

Solution—At this temperature we will neglect the deviation from the ideal gas laws and, therefore, assume that the fugacity coefficients are unity.

$$K = (p_R p_S)/p_A$$

where A is C_9H_{12}, R is C_6H_6 and S is C_3H_6.
If we let x equal the equilibrium conversion:

Constituent	Moles	Mole Fraction	Partial Pressure
C_9H_{12}	$1 - x$	$(1 - x)/(1 + x)$	$\pi(1 - x)/(1 + x)$
C_6H_6	x	$x/(1 + x)$	$\pi x/(1 + x)$
C_3H_6	x	$x/(1 + x)$	$\pi x/(1 + x)$
Total	$1 + x$		

$$K = p_R p_S/p_A$$

$$= \frac{\pi[x/(1 + x)]\pi[x/(1 + x)]}{\pi[(1 - x)/(1 + x)]}$$

$$= \frac{(\pi x)(\pi x)(1 + x)}{(1 + x)(1 + x)\pi(1 - x)}$$

$$K = \pi x^2/(1 + x)(1 - x) = \pi x^2/(1 - x^2)$$

$$K - Kx^2 = \pi x^2$$

$$K = (\pi + K)x^2$$

$$x^2 = K/(\pi + K)$$

Now at 960 deg. F., $K = 9.25$ and at 1 atm. pressure,

$$x^2 = 9.25/(9.25 + 1.0) = 0.90$$

$$x = 0.95$$

or 95 percent of the cumene decomposed at equilibrium. At 6.0 atm. pressure,

$$x^2 = 9.25/(9.25 + 6.0) = 9.25/15.25 = 0.606$$

$$x = 0.779$$

or 77.9 percent of the cumene decomposed at equilibrum.

Nomenclature (Consistent Units)

a	Activity
A	Component in a reaction
B	Component in a reaction
c_{pm}	Mean heat capacity, constant press., weight basis
C_{pm}	Mean heat capacity, constant press., molal basis
f	Fugacity
(g)	Standard state, gaseous
ΔH	Heat of reaction
$\Delta H°$	Standard heat of reaction
$\Delta H°_T$	Standard heat of reaction, temperature T.
K	Equilibrium constant, unit fugacities
K_p	Equilibrium constant, other than unit fugacity
(l)	Standard state, liquid
p	Pressure
r	A ratio of reacting components, see p. 206
R	Component in a reaction
(s)	Standard state, solid
ΔS	Entropy change
$\Delta S°$	Standard entropy change
$\Delta S°_T$	Standard entropy change, temperature T
T	Absolute temperature, deg. K. or deg. R.
W	Weight of reacting mass
x	Degree of conversion in a reaction
y	Degree of conversion, another reaction
ν	Fugacity coefficient
π	Total pressure

Additional Subscripts

A, B, R, S	Of component A, B, R, S, etc.
0, 1, 2	Indicating varying temperature levels or different reactions

Reactions Involving Gases and Solids

We have demonstrated how to calculate the equilibrium composition for a reaction involving only gases. Let's consider the case where a gas reacts with a solid as in the reaction,

$$C\ (s) + CO_2\ (g) \rightleftarrows 2CO\ (g)$$

Here,

$$K = f^2 \text{ (for carbon monoxide)}/f \text{ (for carbon dioxide)}$$

$$K = \nu^2_{CO} p^2_{CO}/\nu_{CO_2} p_{CO_2}$$

The term f_c does not appear for carbon because the carbon remains in the solid state right up until the time it reacts. Therefore it is present only in its standard state, that is, as the pure solid. For this reason the fugacity of carbon is that of the pure substances, at the temperature and pressure of the system.

Now it so happens that in tabulating of enthalpy and entropy data for solids, the standard state used is the pure substance at the standard temperature. The calculation which corrects $\Delta H°$ and $\Delta S°$ for temperature automatically provides for the correction of the fugacity of the solid from the standard temperature to the temperature of the system.

Thus, the standard state for solids is the temperature of the system at 1 atm. pressure. However, the fugacity of solids is almost independent of pressure and so the fugacity of a solid at the pressure of the system is the same as that at 1 atm. for all practical purposes.

The activity of any solid (carbon in this reaction) is practically unity and the term does not appear in the equilibrium equation. (You will note that we talk about the activity of solids and liquids—by custom—and the fugacity of gases.)

It should be noted, however, that the thermal properties of carbon must be used in calculating the values of K.

Equilibrium Concentration Problems

Problem—If some solid ammonium chloride were heated in a closed container at 1,000 deg. K., what pressure would be developed?

Solution—The pressure developed would be due to the NH_3 and HCl gases formed. The NH_4Cl would decompose until the equilibrium partial pressures of the gases are reached.

Let's write the equation and substitute symbols for the reactants and products.

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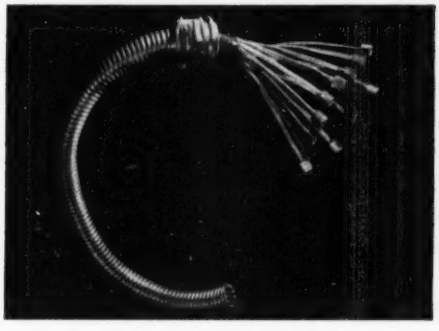

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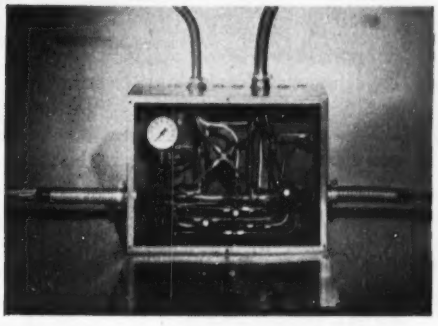

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$$NH_4Cl\ (s) \rightleftarrows NH_3\ (g) + HCl\ (g)$$
$$A \rightleftarrows R + S$$
$$K = f_R f_S / a_A$$

Since the NH_4Cl remains a pure solid, $a_A = 1.0$ and,

$$K = f_R f_S$$

If we assume both gases to remain ideal, then

$$K = p_R p_S$$

but,

$$p \text{ (for } NH_3) = p \text{ (for HCl)}$$

Therefore, if p is the partial pressure of either gas,

$$p^2 = K = 200$$
$$p = 14.1 \text{ atm.}$$
$$p \text{ (for } NH_3) = 14.1 \text{ atm.}$$
$$p \text{ (for HCl)} = 14.1 \text{ atm.}$$

And the total pressure is approximately 28.2 atm. (The total pressure would be slightly greater than 28.2 atm. because of the inert gas originally present in the container.)

Simultaneous Reactions

When two isothermal reactions take place simultaneously, the calculation is slightly more involved but it can still be solved readily. The solution of this kind of problem involves two unknowns: x, the amount of conversion by reaction (1) and y, the conversion by reaction (2). The procedure is to set up the equations involving the equilibrium constant for each reaction and to solve the simultaneous equations graphically.

Assume that the following two ideal gas reactions occur simultaneously and are isothermal:

(1) $A + B \rightleftarrows R$ $\quad K_1 = p_R/p_A p_B$

(2) $A + R \rightleftarrows S$ $\quad K_2 = p_S/p_A p_R$

If we use r to designate the ratio of B to A in the feed, x to designate the degree of conversion by reaction (1) and y to designate that by reaction (2), we can set up the following table:

Basis: 1 mole of A in the feed

Component	Moles/Mole of A	Mole Fraction
A	1	$1/(1+r+x)$
B	r	$r/(1+r+x)$
R	$x-y$	$(x-y)/(1+r+x)$
S	y	$y/(1+r+x)$
Total	$1+r+x$	

In the case where the total pressure is 1 atm., the partial pressures are equal to mole fractions and the two equations become:

$$K_1 = (x-y)(1+r+x)/r$$
$$K_2 = y(1+r+x)/(x-y)$$

Since the K's are constant and can be calculated from thermal data, and since r is usually specified, the two equations can be solved simultaneously.

The easiest method, generally, is to plot y versus x in both equations and the point of intersection gives the desired x and y values. See Fig. 1.

Simultaneous Reaction Problems

In the solution of problems involving simultaneous reactions the most complicated part is usually the algebraic solution of the equations for x and y. These equations are generally cubic, fourth power, or higher. In order to illustrate the principle of simultaneous equilibrium, we will use a simplified problem involving hypothetical compounds. This will serve to illustrate the principle and at the same time minimize the algebra.

Problem—Assume that a gas, A, may decompose into either R or S by the following equations:

(1) $A \rightleftarrows R$ $\quad K_1 = 1.0$

(2) $A \rightleftarrows S$ $\quad K_2 = 2.0$

Calculate the composition that would result when equilibrium is reached.

Solution—We will let x equal the moles of A converted by reaction (1), and y equal the moles of A converted by reaction (2).

Component	Moles	Mole Fraction	Partial Pressure
A	$1-x-y$	$1-x-y$	$1-x-y$
R	x	x	x
S	y	y	y
Total	1	1	1

$$K_1 = p_R/p_A = x/(1-x-y) = 1.0$$
$$K_2 = p_s/p_A = y/(1-x-y) = 2.0$$

From reaction (1),

$$x = 1 - x - y$$
$$y = 1 - 2x$$

From reaction (2),

$$y = 2(1-x-y) = 2 - 2x - 2y$$
$$3y = 2 - 2x$$

Therefore,

$$3y = 3 - 6x$$
$$3y = 2 - 2x$$
$$0 = 1 - 4x$$
$$x = 0.25$$
$$y = 1 - 2x$$
$$y = 0.50$$

Mole fraction $A = 1 - x - y = 0.25$ Composition $A = 25\%$

$R = x = 0.25$ $R = 25\%$

$S = y = 0.50$ $S = 50\%$

Adiabatic Reactions

In the problems thus far demonstrated we have calculated the equilibrium conversion for cases in which the reaction took place at a constant temperature. In many industrial practices no heat is added or removed during the process and the heat of reaction must originate from or be dispersed in the reacting system itself. Therefore, the temperature of the reacting mass will change continuously during the reaction. And a calculation of

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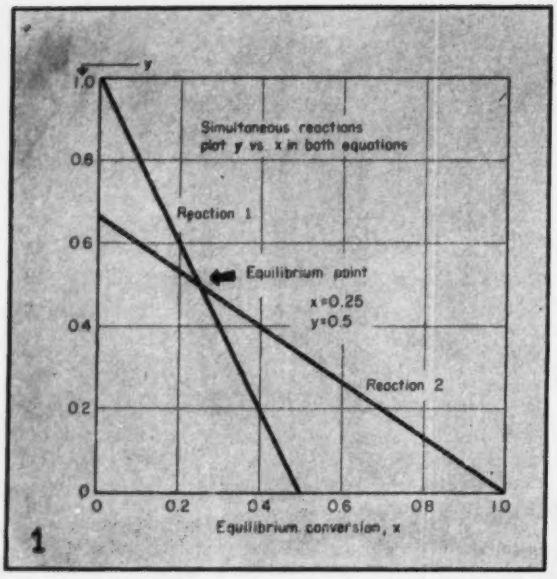

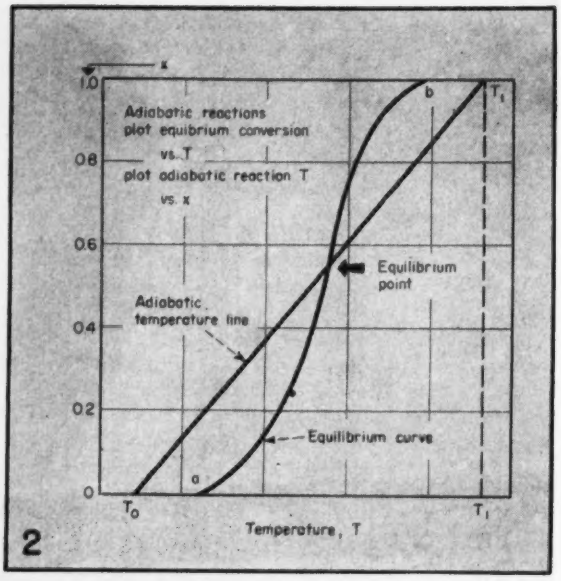

the equilibrium composition will also involve one of the final temperature. This type of problem is solved most easily by a graphical method. See Fig. 2.

The method of solution for adiabatic reactions presented here will be for the simplified case in which we can assume that $\Delta H°_T$ and $\Delta S°_T$ are relatively constant over the temperature range involved.

If this is the case a plot of log K versus $1/T$ will result in a straight line. The calculation involves two relationships between T and x (the degree of conversion). One is a simplified energy balance; the other is the relation involving the equilibrium constant. The procedure is as follows:

1. By methods previously discussed, calculate K for two temperatures and plot log K versus $1/T$. This will be a straight line if $\Delta H°$ and $\Delta S°$ are assumed constant.
2. Assume even values of conversion (x) from 0 to 1.0 and calculate the corresponding partial pressure of each gas present for each value of x.
3. Using the correct ratio of partial pressures, calculate the value of K for each value of x.
4. Using the log K versus $1/T$ plot, evaluate T for each value of x and plot x versus T. (Curve ab in Fig. 2.)
5. Use a simple energy balance to obtain the other relationship between T and x.

$$(\Delta H)(x) = Wc_p(T_1 - T_0)$$

where W = weight of reacting mass; c_p = specific heat at constant pressure on a weight basis; H = heat of reaction; and x = degree of conversion.

If we let $x = 0$ in this equation then,

$$(T_1 - T_0) = 0$$

and where $x = 1$,

$$(T_1 - T_0) = \Delta H/Wc_p$$
$$T_1 = \Delta H/(Wc_p + T_0)$$

The line connecting T_1 and T_0 is drawn in.

6. The intersection of the two lines gives the desired values of x and T.

The calculation described above is very much simplified. For cases in which the assumptions of constant ΔH and ΔS do not hold, or for cases in which K_p is of significant value, the reader is referred to standard texts on thermodynamics.

Adiabatic Reaction Problems

Problem—A stream of carbon dioxide and a stream of hydrogen are preheated to 1,400 deg. F. and brought together in an adiabatic reactor at 1 atm. pressure over a "shift-reaction" catalyst. What are the temperature and composition at equilibrium?

Solution—We'll apply the short cut procedure outlined above.

Step 1—Plot log K versus $1/T$. Using the method described on p. 202 calculated values of K are as follows:

T (°K.)	K	Log K
700	0.1109	−0.9550
1,200	1.4355	0.1570

Since the problem was given in deg. F., we'll change scales as shown below:

T (°K.)	T (°R.)	T (°F.)	$1/T$ (°R.)
700	1,260	800	$7.95(10^{-4})$
1,200	2,160	1,700	$4.69(10^{-4})$

The equation is:

$$\log K = (-3{,}388.7/T) + 1.744$$

Steps 2 and 3—For values of x from 0 to 1.0, calculate the corresponding partial pressure of each gas. Then evaluate the corresponding values of K.

$$CO_2 + H_2 \rightleftarrows CO + H_2O$$
$$1-x \quad 1-x \quad x \quad x$$

Component	Moles	Mole Fraction	p (Where $x = 1.0$)
CO_2	$1-x$	$(1-x)/2$	$(1-x)/2$
H_2	$1-x$	$(1-x)/2$	$(1-x)/2$
CO	x	$x/2$	$x/2$
H_2O	x	$x/2$	$x/2$
Total	2		

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These desired characteristics are inherent in the
NEW DIEHL TYPE "D" MOTORS

STATOR INSULATION is doubled in dielectric strength and exceptionally resistant to moisture, oil, chemicals and abrasion.

LEADS are specially insulated, last longer. Occupy less space. Permanently numbered to save wiring time.

BALL BEARINGS are oversize to provide excess load capacity. Pre-lubricated for years of trouble-free service.

INDESTRUCTIBLE ALUMINUM ROTORS. Keyed to the shafts in most frame sizes to prevent looseness under unusual and severe load conditions.

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Former N.E.M.A. Standard frame sizes still available for interchange and replacement.

Cutaway view of new Diehl Type "D" Motor

Motors that require least maintenance, stay on the job longest and deliver peak performance under the most severe operating conditions assure *maximum value per dollar invested.*

DIEHL MANUFACTURING COMPANY
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Finderne Plant, SOMERVILLE, N. J.

Please send me the following bulletins
☐ Type "J" Power Transmitter Bulletin No. CE -3303.
☐ Consolidated Motor Catalog and Price List No. CE -3310

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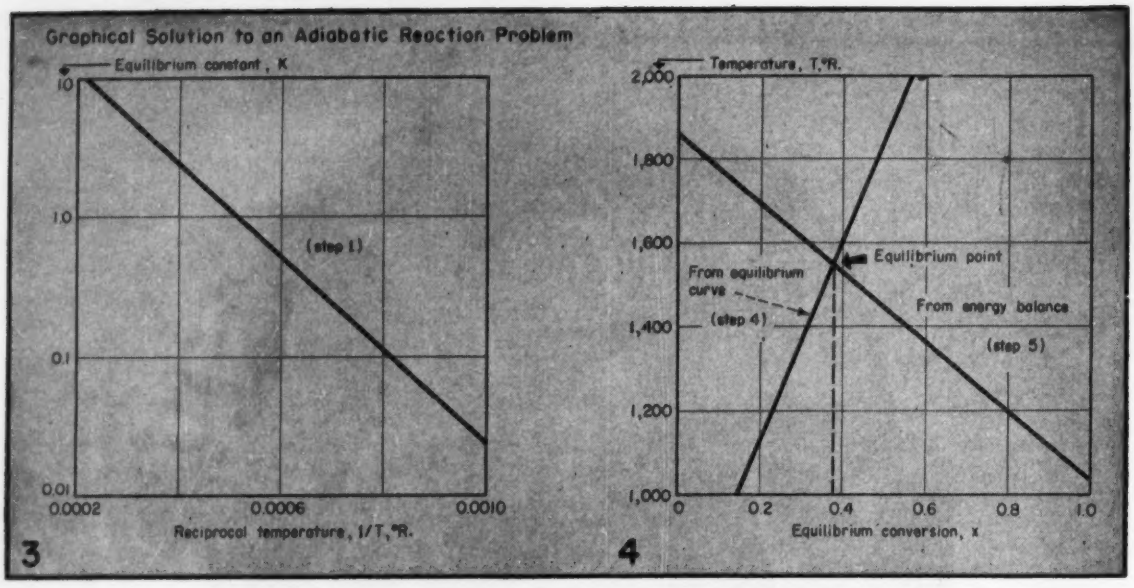
OTHER INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES



$$K = \frac{p_{CO}p_{water}}{p_{CO_2}p_{hydrogen}} = \frac{(x/2)(x/2)}{[(1-x)/2][(1-x)/2]}$$

$$K = x^2/(1-x)^2$$

Assumed Value of x	x^2	$1-x$	$(1-x)^2$	K (Calculated)
0	0	1.0	1.0	0
0.2	0.04	0.8	0.64	0.0625
0.4	0.16	0.6	0.36	0.444
0.6	0.36	0.4	0.16	2.25
0.8	0.64	0.2	0.04	16
1.0	1.0	0	0	

Step 4—Use the log K versus $1/T$ plot to evaluate a corresponding value of T for each value of x.

x	K	Log K	Log K	$1/T$	T (°R.)
0	0	$-\infty$	$-\infty$		
0.2	0.0675	8.796−10	−1.204	$8.74(10^{-4})$	1,150
0.4	0.444	9.648−10	−0.352	$6.18(10^{-4})$	1,620
0.6	2.25	0.353	0.353	$4.12(10^{-4})$	2,430
0.8	16	1.204	1.204		
1.0	∞				

Step 5—Use an energy balance to obtain the other relationship between T and x.

$$-(\Delta H)(x) = Wc_{pm}(T_1 - T_0)$$

ΔH (average) = 15,200 (for equation as written)

W = 1 mole CO_2 + 1 mole H_2 = 44 + 2 = 46 lb.

T_0 = 1,400° F. = 1,860° R.

We can find values of C_{pm} at T_0:

CO_2	13.1 Btu./lb-mole
H_2	7.22 Btu./lb-mole
CO	8.0 Btu./lb-mole
H_2O	9.0 Btu./lb-mole

At $x = 0$, $c_{pm} = (13.1 + 7.22)/46 = 0.44$ Btu./lb.

At $x = 1.0$, $c_{pm} = (8.0 + 9.0)/46 = 0.37$ Btu./lb.

We will use 0.4 as an average value.

$$\Delta H(x) = Wc_{pm}(T_1 - T_0)$$
$$(T_1 - T_0) = (-\Delta Hx)/Wc_{pm}$$
$$= -15{,}200x/(46)(0.4)$$
$$(T_1 - T_0) = -825x$$

x	$T_1 - T_0$	T (°R.)
0	0	1,860
0.8	−660	1,200

From the graph (Fig. 4),

x = 0.375 = 37.5% converted

T_1 = 1,560° R. = 1,100° F.

Now we can check our graphical answer by calculating back. At x = 0.375,

$$K = x^2/(1-x)^2 = (0.375/0.625)^2 = 0.36$$
$$\log K = 9.568 - 10 = -0.432$$
$$1/T = 6.41(10^{-4})$$
$$T = 1{,}560° \text{ R.}$$

Now we can solve for C_{pm} as follows:

$$C_{pm} = (13.1)(0.625) = 8.20$$
$$(7.2)(0.625) = 4.50$$
$$(8.0)(0.375) = 3.00$$
$$(9.9)(0.375) = 3.72$$
$$C_{pm} = 19.42 \text{ Btu./lb.-mole}$$

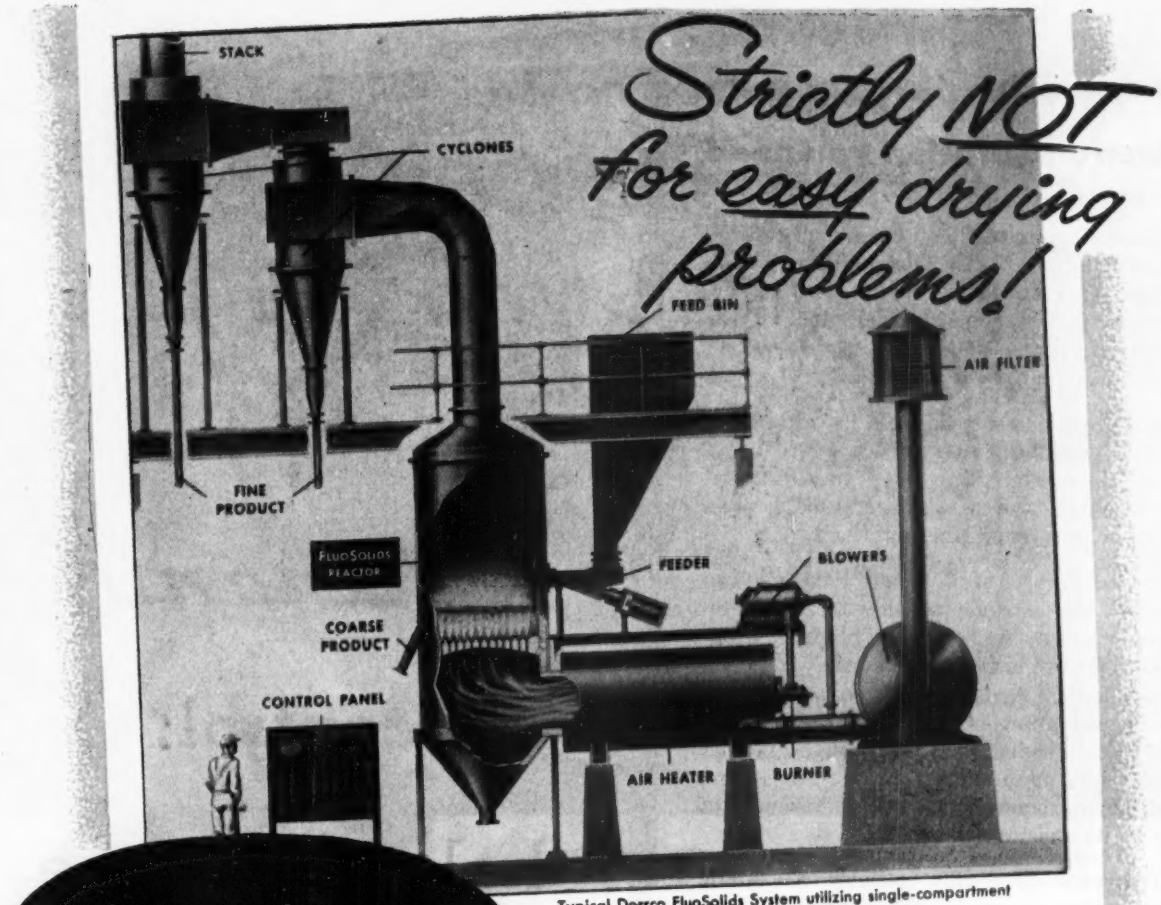
$$c_{pm} = 19.42/46 = 0.423 \text{ Btu./lb.}$$
$$T_1 = (-15{,}200)(0.375)/(46)(0.423) + 1{,}860$$
$$T_1 = -292 + 1{,}860 = 1{,}568° \text{ R.}$$

And our calculated answer, T_1 = 1,100 deg. F., checks with our answer from the graphical solution. Our final task is to calculate the equilibrium composition.

Composition x = 0.375

CO_2	$(1-x)/2 = 0.625/2 = 0.312 = 31.2\%$
H_2	$(1-x)/2 = 0.625/2 = 0.312 = 31.2\%$
CO	$x/2 = 0.375/2 = 0.188 = 18.8\%$
H_2O	$x/2 = 0.375/2 = 0.188 = 18.8\%$

Next Month—Chemical Equilibrium-IV will conclude our discussion of this section with a consideration of the effect of dissociation on theoretical flame temperature and some explanations about standard states.



Strictly NOT for easy drying problems!

Typical Dorrco FluoSolids System utilizing single-compartment Reactor for critical temperature drying.

FluoSolids

designed for the job where exact temperature control is essential to eliminate or induce chemical or physical raw material change.

If you merely want to remove free moisture and don't need close temperature control — read no further. But if temperature variations in your drying operation are important — if you have to avoid chemical or physical changes in your raw material like poison — or even if you have to induce them — FluoSolids may be your answer.

Why FluoSolids? Well, mostly because it involves techniques that are radically different from conventional drying methods. More specifically, because it lets you control temperature precisely and automatically (within 10 to 20 degrees). You'll get completely uniform temperature throughout the entire fluidized bed without hot spots — and that means product uniformity. Oil, Gas or Coal can be used as fuel.

There are other advantages too. You can cut fuel requirements by the use of a multiple compartment FS Reactor — which puts otherwise wasted heat to work. You'll find operating costs low because of complete yet simple instrumentation. And maintenance costs are surprisingly low because no moving parts are required in the Reactor itself.

Important point is though, FluoSolids is the best answer yet to the critical temperature drying job. And from the capacity standpoint, single units can handle from 10 to 500 tons per day depending upon individual job requirements.

We'd like to send you more detailed information. No obligation of course. The Dorr Co., Stamford, Conn.

*Reg. U. S. Pat. Off.

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Better tools TODAY to meet tomorrow's demand

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From one source . . . any instrumentation you need

When it comes to measurement and control, every industrial process is different. Each demands its own combination of accuracy, economy, instrument ranges, and all the numerous other characteristics that are peculiar to the individual application.

No single instrument and its accessories could possibly fit every process. So Honeywell makes a broad variety of measuring and controlling equipment that spreads across a tremendous range of applications.

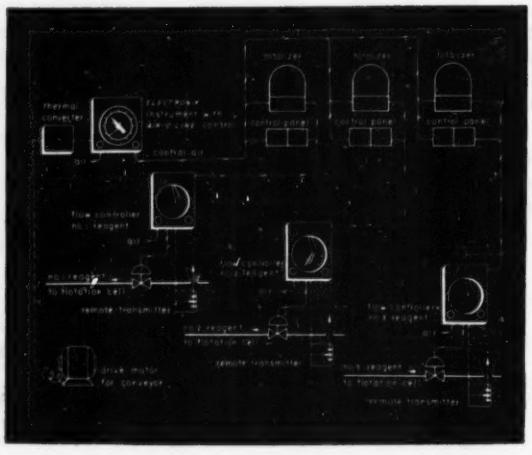
The advantages are two-fold. First, you can get all the instrumentation your process requires from a single source, so there is undivided responsibility for the complete installation. And second, you are assured that the equipment selected for your process is recommended without bias . . . neither over-sells nor under-equips . . . needs no stretching, squeezing or compromising to fit it to its assignment.

This versatile family includes *ElectroniK* indicators, recorders and controllers in circular and strip chart models, applicable to temperature, pressure, pH, power and dozens of other variables; square root flow meters for control applications; evenly graduated flow meters for cost accounting; thermometers, pressure gauges and liquid level meters; *Pyr-O-Vane* millivoltmeter controllers. Especially useful for graphic panels are the *Tel-O-Set* miniature indicators, recorders and controllers. Electric and pneumatic control systems range from the simplest to the most complex, including automatic program controls and complete systems developed for particular processes.

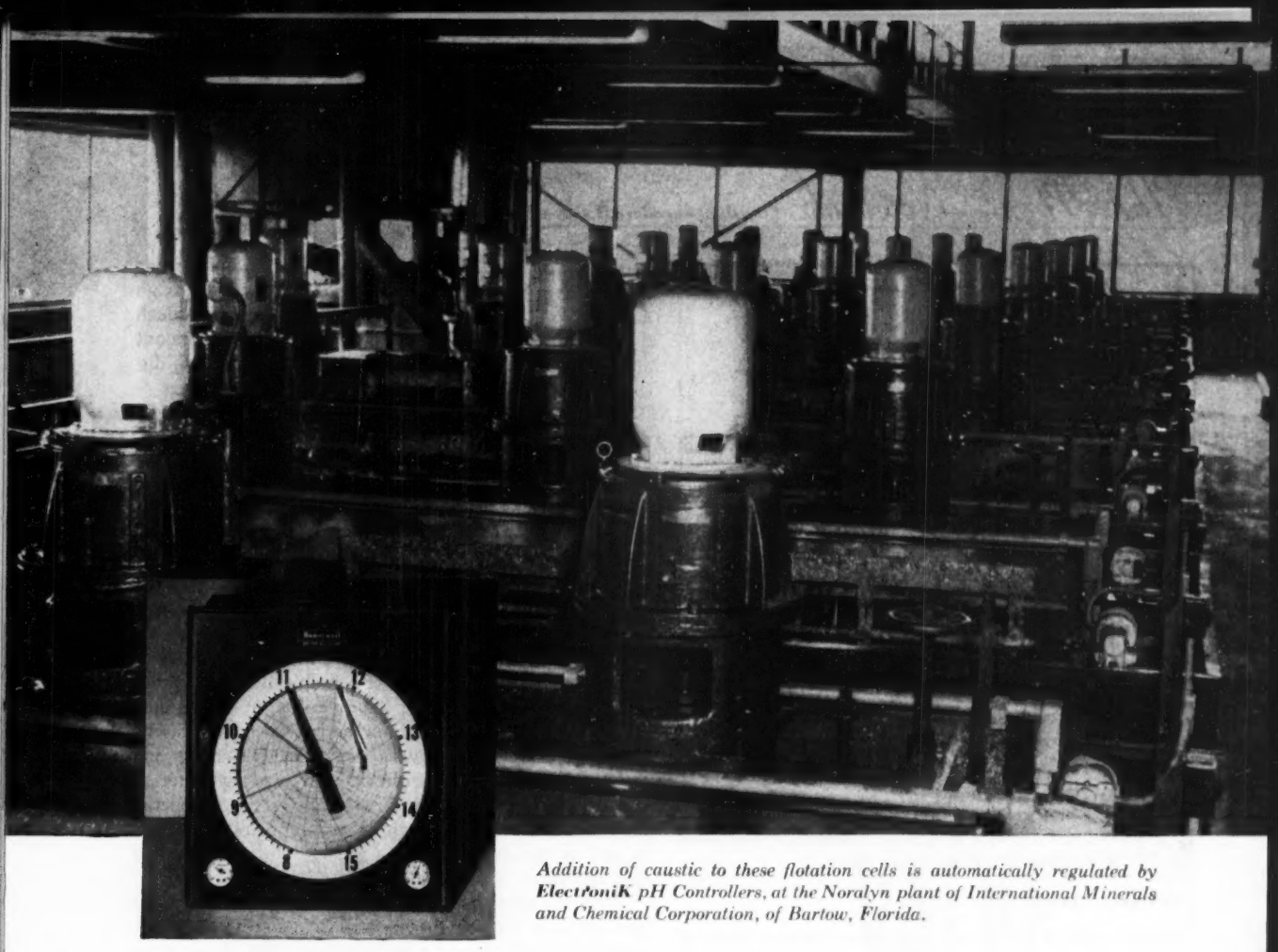
Working with these instruments is a full choice of primary elements . . . thermocouples, *Radiamatic* radiation elements, pressure-type and electrical resistance thermal systems, flow meter bodies, pH cells and many others. For final control elements, you can choose from a wide range of electric motorized and diaphragm operated valves. To complete the picture, there are more than 7000 non-indicating devices for controlling temperature, pressure, vacuum, liquid level and humidity . . . an unmatched variety of instrumentation made by the world's largest manufacturer of control equipment.

ElectroniK

pH control helps increase the yield from



Schematic diagram of pH control system for addition of caustic to phosphate flotation process.



Addition of caustic to these flotation cells is automatically regulated by ***ElectroniK*** *pH Controllers, at the Noralyn plant of International Minerals and Chemical Corporation, of Bartow, Florida.*

phosphate ore beneficiation

THE APPLICATIONS of *ElectroniK* instrumentation to the beneficiation of phosphate ore, at International Minerals and Chemical Corporation, demonstrate how modern control techniques help make heavy chemical processing more automatic . . . more efficient.

The flotation process, where silica sand is removed from the phosphate slurry, operates best within close pH limits. Through the use of an *ElectroniK* pH Controller, caustic is automatically added at the proper rate to maintain the desired alkalinity. A sample of slurry is continuously withdrawn from one of the flotation cells, and the liquid is passed through a pH electrode assembly. Connected to this detecting element through an amplifier is an *ElectroniK* instrument, which records the pH value and, through its *Air-O-Line* control, resets a caustic flow controller. The complete system provides sensitive, accurate adjustment of caustic flow . . . holds pH well within the desired tolerances for peak production.

Instrumentation by Honeywell puts top performance into today's process control systems. Through years of experience in chemical processing problems, Honeywell specialists are qualified to engineer the kind of control your process needs, by utilizing the uniquely wide variety of recording and controlling instruments which Honeywell has developed for this field.

Your nearby Honeywell sales engineer will welcome the opportunity to discuss your specific application . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Catalog 1550, "pH and Conductivity Recorders and Controllers," and for Catalog 1531, "*ElectroniK* Controllers."**

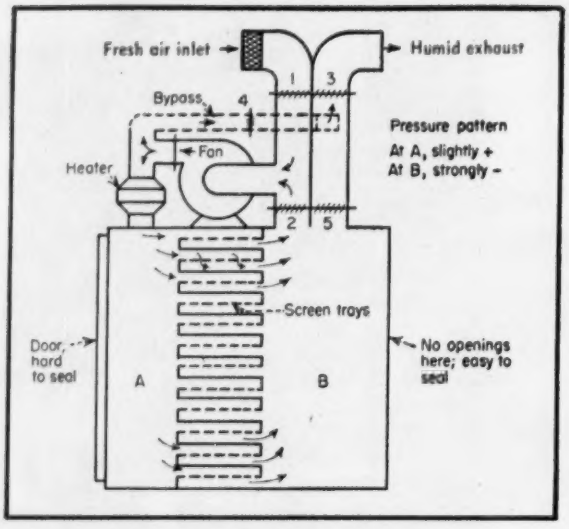
MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

The Plant Notebook

Edited by Theodore R. Olive



Bypass Improves Operation of Hot Air Tray Dryers

P. I. Johnson, *Chemical Engineer, Naugatuck Chemical Div., U. S. Rubber Co., Naugatuck, Conn.*

*** February Contest Prize Winner**

When toxic or obnoxious chemicals are dried in standard down-draft tray dryers the working conditions may be bad due to leakage of air around the doors through which the dryers are loaded. The sketch shows the arrangement of a typical dryer of this sort and also shows the addition of a simple bypass (dotted) which enables the pressure pattern to be changed so that leakage is no longer a problem, drying is speeded, and steam consumption is reduced. This improvement is actually in use and is working satisfactorily.

As the dryers were originally installed, without the bypass, the pressure above the trays at the left or door side had to be considerably above atmospheric to force the air through the material on the screen trays. Pressure beneath the trays and at the right or return side was close to and slightly above atmospheric. In the arrangement shown, fresh air was drawn in through a filter and damper No. 1, mixed with recirculated air through damper No. 2, and the mixture blown by the fan through a heater and into the dryer above the trays. An amount of humid air equal to the incoming fresh air was discharged through damper No. 3 and the exhaust duct.

The change consisted simply in adding a bypass, shown dotted, between the fan discharge and the exhaust stack. Dampers No. 4 and 5 were added to enable flows to be balanced. Now No. 5 is closed, Nos. 1 and 4 are opened slightly and No. 2 is operated nearly wide open so that a high proportion—more than 95 percent with some products—of the air handled by the fan is recirculated. Only a little fresh air need be admitted to carry away the moisture via the exhaust air which now moves through the new bypass to the exhaust stack. With such an air distribution the pressure pattern is entirely different than before, and leakage is no longer a problem.

At the left or door side of the dryer the pressure is now only very slightly above atmospheric—so as to prevent in-leakage of room air, with probable channeling and uneven drying. The pressure beneath the trays, and at the right side of the dryer, is strongly sub-atmospheric. However, there are no doors or other openings difficult to seal in the dryer casing to the right of the trays, so that in-leakage is no problem.

With the new arrangement we are able to get a greater pressure drop through the material being dried, therefore, a higher air velocity and a greater drying rate. Since there is no longer any leakage into the room, the recirculation can be greater, which means lower steam consumption per pound of dried product. But of all the advantages, the most important is the improvement in working conditions and in worker morale through the elimination of hot air and fume leakage which formerly made the nearby working areas both unpleasant and unsafe.

Tricks for Gas Cylinder Users

E. J. Erwood, *Research Div., Beta Research Laboratory, Chicago 23, Ill.*

When compressed gas cylinders are hooked up to a discharge pipe or manifold, the valve assembly is often

---

★ March Contest Prize Winner

"Spare Wooden Tank Makes an Effective Acid Fume Scrubber."

A prize of $50 in cash will be awarded to J. E. Weiler, process engineer, Niagara Falls, N. Y. His economical solution to an air pollution problem will be published in the June Plant Notebook.

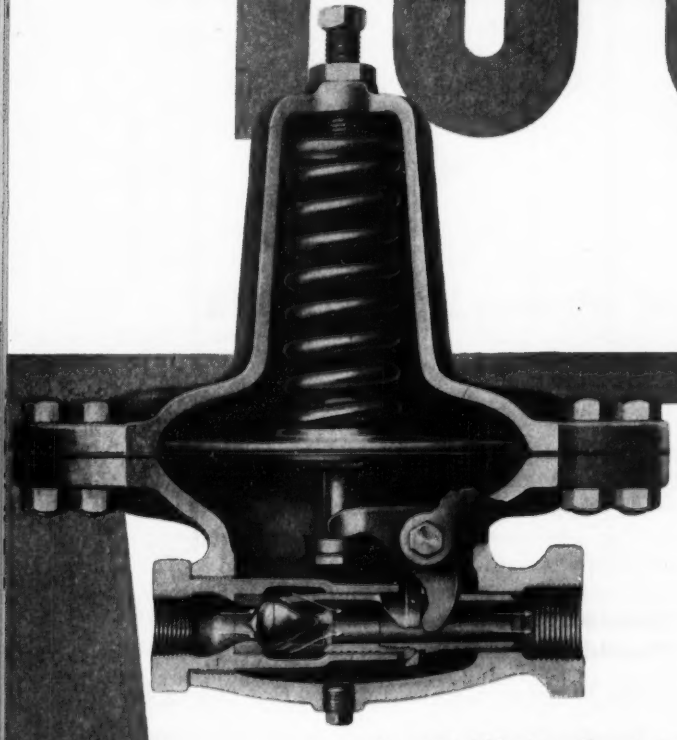
$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. Each month's winner will be announced the second following month and published the third following month.

$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article, which will then be awarded an additional $100 prize.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Articles which are acceptable but are not winners will be published at regular space rates ($10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

TYPE 1000 VALVE



Any product of quality should be dependable when *ordinary* products fail. Sudden pressure fluctuations, dirt, scale and viscous matter prove "fatal" to ordinary pressure reducing valves.

The CASH STANDARD TYPE 1000 VALVE however, is designed to operate with complete dependability under the most difficult and unusual circumstances. Many of these units have been in service over 10 years and have never been taken "out of the line."

Truly an *EXTRAORDINARY* achievement of quality and design excellence.

INSTALL CASH STANDARD "TYPE 1000" VALVES

CASH STANDARD **DECATUR, ILLINOIS**

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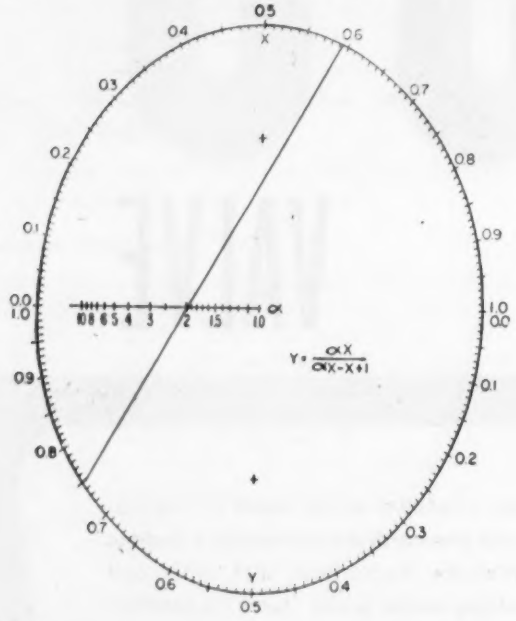
exposed to falling objects or to oil or chemical spray. Not only have we found a simple way to guard against such hazards, but at the same time we found a use for empty beer cans—which is quite an accomplishment in itself.

An empty beer can is just the right size to protect standard high-pressure gas tank valve assemblies—2⅞ in. in diameter and 4⅞ in. high. Cut out one end, then cut a notch in the side of the can at the same end, roughly 1½ in. wide and 2¾ in. high. This allows for the discharge pipe when the can is placed over the valve assembly. The can may be colored brightly, so as to indicate clearly at a distance which of the cylinders are connected to the discharge piping.

Incidently, here is another use for molybdenum disulfide powder, which has recently come in for so many new applications as a dry lubricant. It can be used to get rid of the irritating squeak and the difficulty of removing compressed gas cylinder caps. Oil should never be used on such caps, of course. However, the threading and fittings used with the gases should not be similarly lubricated.



Nomograph Solves Equation For Binary Mixtures

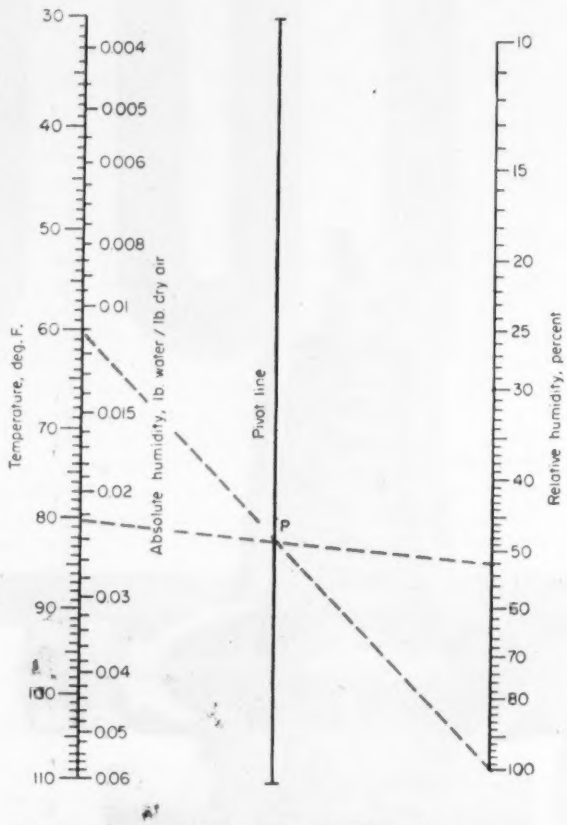
JOHN W. COLTON, *New York, N. Y.*

Reproduced above is an unusual elliptical nomograph which solves the general equation:

$$Y = \frac{\alpha X}{\alpha X - X + 1}$$

This form of equation is encountered frequently with binary mixtures, either in determining vapor-liquid equilibria of mixtures which obey Raoult's Law, or in relating mole fraction and weight fraction. For example, for the first case, X = mole fraction in the liquid of the more volatile compound, Y = mole fraction in the vapor, and α = relative volatility. For the second type of application X = mole fraction of the heavier component, Y = weight fraction, and α = ratio of molecular weights.

Conventional linear nomographs have previously been drawn for this equation, but these are of limited range. The elliptical nomograph preserves accuracy at both low and high range. So far as I know it is novel for this purpose. However, it is probable that a better curve could be drawn with a better ratio of minor and major axes. In fact, I cannot give a mathematical derivation, but can state that it does give the correct answer. For example, where $X = 0.6$ and $\alpha = 2.0$, $Y = 0.75$ exactly, as the chart shows.

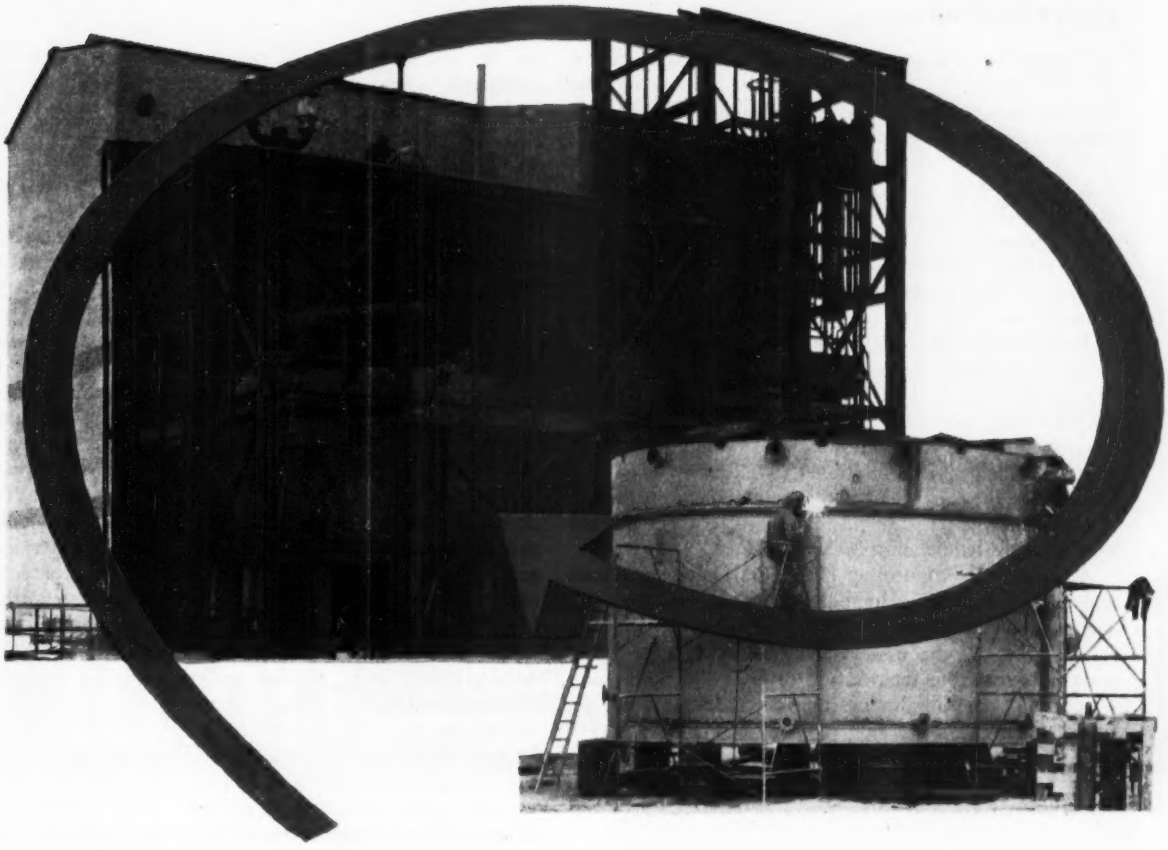


Moisture Content Chart Speeds Humidity Calculations

JOSEPH T. HOGAN, *Chemical Engineer, New Orleans, La.*

Knowledge of the atmospheric moisture content is essential for the successful solution of many types of engineering problems in air conditioning, refrigeration, and forced-air-dryer operation. For purposes of assembling data to be used in developing design requirements for future drying facilities and improvements in the use of future and existing equipment, information on the absolute humidity to be expected during drying operations becomes necessary. This, of course, depends on the location.

Values of relative humidity and dry-bulb temperature are observed by the U.S. Weather Bureau at many points in the United States and these data are published monthly



BLAW-KNOX puts the skids under a hazardous project to increase Honeymead's capacity

The problem at Honeymead Products Company was . . . how to add solvent extraction facilities, by assembling and welding metal equipment, to an operating plant using volatile, inflammable solvent.

Honeymead is a fast-growing Minnesota producer of soy oil and meal. Extraction of oil from soybean flakes requires the use of hexane solvent. Cutting, welding and assembling the world's largest Rotocel extractor and integrating it with the existing vapor-filled equipment without interrupting operations necessitated a unique engineering approach.

Blaw-Knox fabricated the 500 ton per day Rotocel, 24 feet in diameter, and distillation equipment four stories in height at a safe distance. As each unit was completed, it was lowered onto cribbing and skidded carefully into place.

Eight months from the start of this project, tie-in of the new facilities with the existing meal-preparation equipment was completed. Integration of these facilities, start-up, test runs and adjustments were completed in two weeks—procedures normally requiring a month. This rapid conversion saved the firm many thousands of dollars.

The solution to Honeymead's problem was the unified design, engineering and construction of equipment, and, more important, a method of operation which enabled the company to maintain the income from its existing plant almost entirely throughout the period of construction.

This is the type of thinking you can expect from Blaw-Knox. Put it to work on your next project. Call Blaw-Knox early in the planning stages.

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in reports. Such reports are available but, unfortunately, do not record the absolute humidity. However, the essential information, i.e., relative humidity and dry-bulb temperature, is available for calculation of these data.

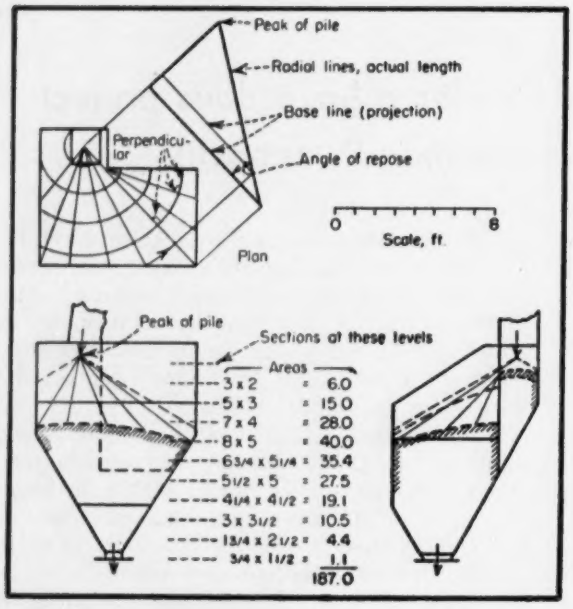
Calculations of the absolute humidity from available data published at New Orleans, La., involved transformation of relative humidity and temperature values to dew-point temperatures and moisture content from observations taken at 6-hr. intervals over a period of 63 years. Nomographic solution of this problem seemed more convenient than the use of tables or psychrometric charts, in addition to being easier on the eyes for repetitive use.

The accompanying nomograph was devised for the reducing of separate observations of relative humidity and dry-bulb temperature to dew point and absolute humidity at a mean atmospheric pressure of 30 in. Hg. Use of the nomograph may be illustrated as follows:

What is the dew point and absolute humidity of the atmosphere when the relative humidity is 51.5 percent at a dry-bulb temperature of 80 deg. F.?

A straightedge connecting 80 on the temperature scale and 51.5 on the relative humidity scale intersects the pivot line at a point *P*. Mark *P*. Then a straightedge, connecting point *P* and the value 100 on the relative humidity scale, intersects the temperature scale at the dew point, 60 deg. F., and the absolute humidity scale at 0.011 lb. of water per lb. of dry air.

Once such meteorological data have been tabulated, the most useful way to employ them is to evaluate them statistically.



Don't Be Fooled by an Irregular Hopper

CHESMAN A. LEE, *Engineer, Darling & Co., Chicago, Ill.*

Often in continuous processes where solids are treated we need surge capacity at various points to insure continuity. It is easy enough to decide on the proper capacity for the necessary hoppers, but hoppers must often be completely unsymmetrical to fit the available space. In such a case it is easy to be fooled by the hopper—for it may be quite hard to determine what its actual capacity will be.

Why this should be true will be clear if we consider the differences between solids in a hopper and liquids in a tank. The liquid surface will be level, and will seek out the farthest cranny of the tank. But if a hopper is filled with solid material in the usual way—from a single point and without any spreading mechanism—then when the hopper is filled to its maximum extent there will still be a considerable volume of hopper unfilled above the free surface of the cone of material, and this volume will depend on the hopper shape and dimensions, and sometimes in a rather inobvious way.

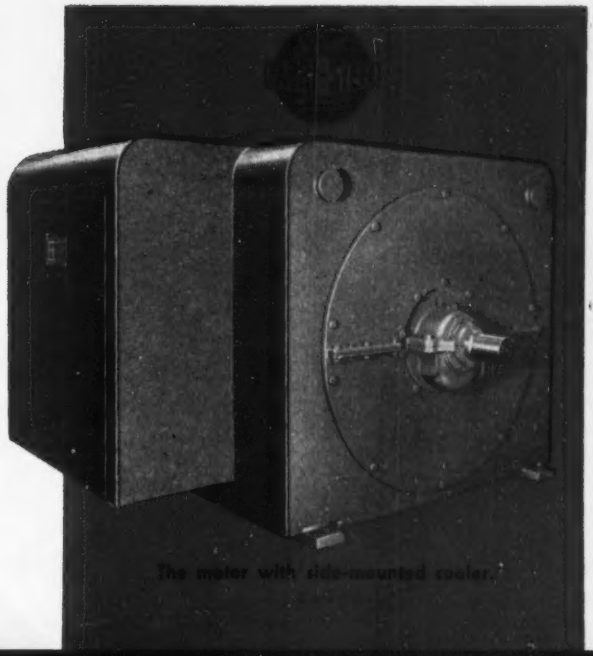
We recently had to check up on an irregular hopper of this sort while it was still in the blue-print stage. To do so we made a set of tracings of two views, and constructed a third. As the sketch shows, the hopper has an offset feed section and its discharge is somewhat off-center. The free slope of the material intersects the hopper walls irregularly, but these intersections are not hard to find by simple descriptive geometry. Putting the tracing over a sheet of cross section paper we can use the horizontal lines to designate a series of sections. Below the surface the sections are bounded by the sides of the hopper. In the cone of material above the intersection the boundaries are drawn as contour lines. Then finally, we can make a quick visual estimate of the dimensions of each "slice" between the section lines, determine the area of each, add all these areas together, multiply by the section height, and so come up with an approximate volume of solids in the filled hopper.

HOW VOLUME IS FOUND

In a little more detail, the first step is to assume a point for the peak of the pile in the plan and elevation views; and in the plan to draw a number of radial lines. Each of these lines is an element in the cone of material. Its intersection with the hopper wall can be determined by setting up a triangle whose base is the horizontal projection of the line, whose slope is the angle of repose of the material and whose height is the difference in elevation between the peak and the intersection. All the radial lines and their triangles can be superimposed. All the intersection points can then be connected by curved lines (at both front and rear) in the two elevation views. The contour lines are best drawn by drawing in the radial lines in the elevations and spotting their intersections with the various horizontal section lines. Note that in the plan the contour lines must cross each radial line at right angles—hence the change of curvature at the right where the radial lines have a different center of curvature.

In the sketch we have scaled the dimensions at each section plane and determined the approximate area. Adding all of these together gives us a gross area which, multiplied by the contour interval of 1 ft. gives a total volume of 187 cu. ft. of material in the hopper. Although this method of approximating the volume isn't very accurate, it can be refined readily to be as accurate as needed.

The economical selection for large motor installations in Class I Division II locations...



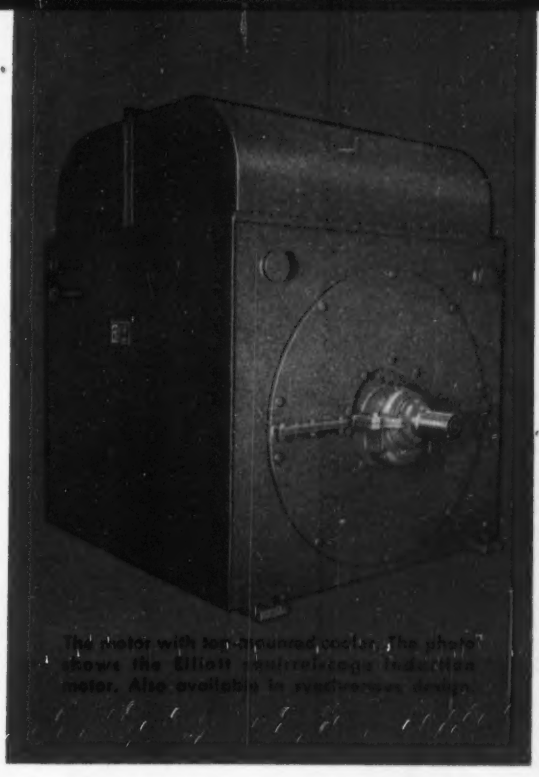
The motor with side-mounted cooler.

ELLIOTT INERT-GAS OR INSTRUMENT-AIR-COOLED MOTORS

These motors are the modern answer to the problem of motor installations above 900 hp in hazardous areas. They represent a substantial saving over the cost of explosion-proof design, the saving in the larger sizes approaching 30%. Furthermore in comparable sizes they provide greater overload capacity, and their size range well exceeds explosion-proof types, going to 4000 hp.

Elliott "Fabri-Steel" construction makes it readily possible to supply these motors in both the types illustrated. The design is basically that of a totally-enclosed water-cooled motor, filled with inert gas or instrument air at .15 psig. Special seals on the shaft prevent gas leakage. Standard equipment includes indicating pressure gauge, low pressure alarm, and pressure regulator. Also, for inert gas, manifold and wall mounting brackets for gas bottles.

Your local Elliott field engineer has full details, or write Elliott Company, Ridgway Division, Ridgway, Pa.

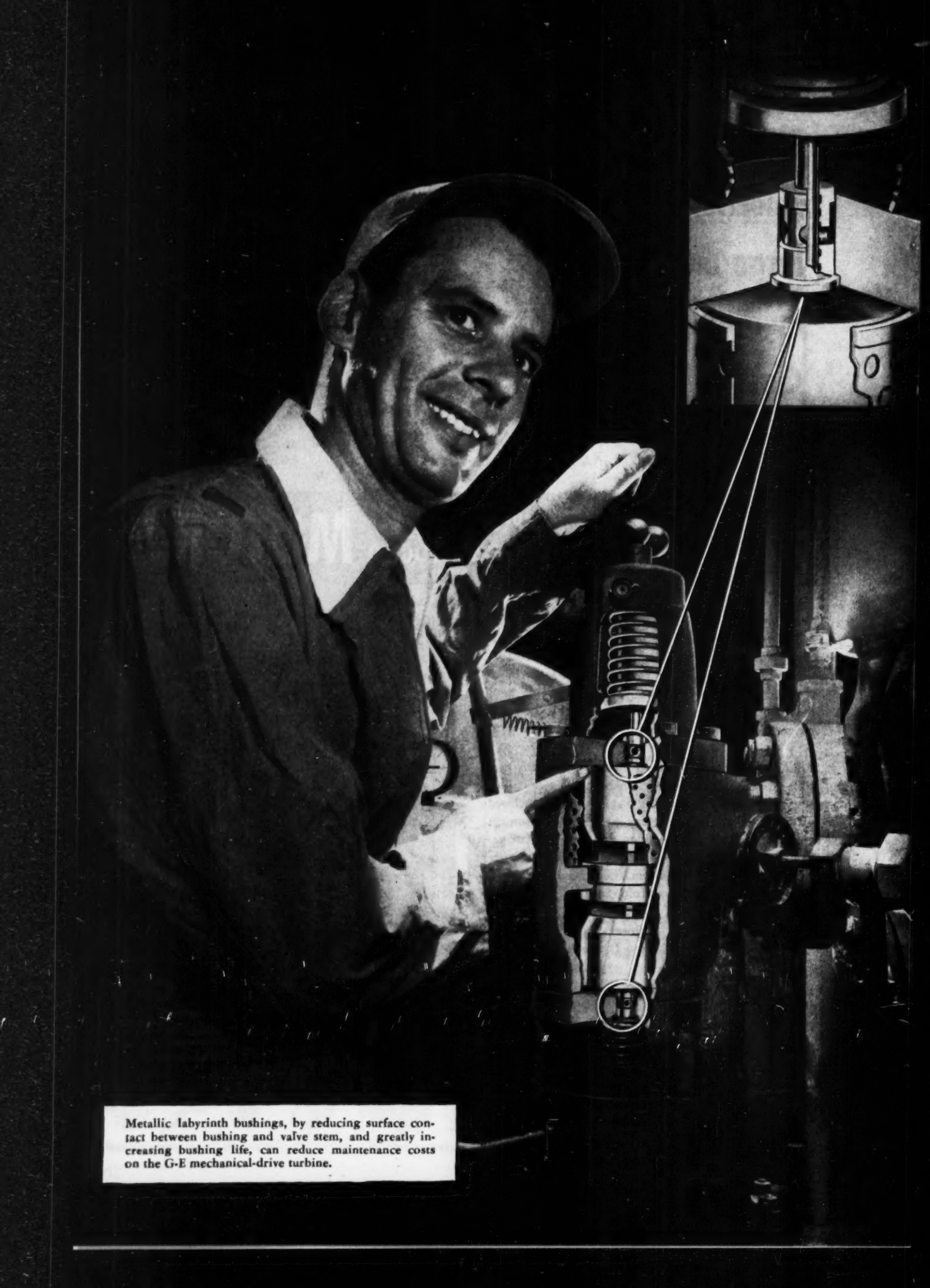


The motor with top-mounted cooler. The photo shows the Elliott squirrel-cage induction motor. Also available in synchronous design.

ELLIOTT Company

R4-8

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS



Metallic labyrinth bushings, by reducing surface contact between bushing and valve stem, and greatly increasing bushing life, can reduce maintenance costs on the G-E mechanical-drive turbine.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

Metallic Labyrinth Bushings Cut Turbine Maintenance Costs

Using metallic labyrinth bushings instead of soft packing on the throttle valve stem and operating valve stem of General Electric's Type DP mechanical-drive turbine has several important advantages. Corrosive attacks on the valve stems, often caused by soft packings, are prevented.

Because surface contact between bushing and valve stem is reduced to a minimum, friction is practically eliminated—bushing life is increased tremendously. This feature alone can save you up to $50.00 in direct maintenance costs—plus the expense of down-time caused by frequent packing replacements.

HERE'S ANOTHER ADVANTAGE. Since frictional drag on the governing system is reduced to a minimum, you get more accurate, sensitive, reliable governing with G.E.'s Type DP turbine.

Metallic labyrinth bushings make an effective steam seal by means of grooves in the bushing which throttle pressure and minimize any steam leakage (see illustration).

THESE METALLIC LABYRINTH BUSHINGS are just one of many DP features which save you money throughout total turbine life. The chart below indicates other areas of savings.

Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features that save you extra costs. For more information contact your nearest G-E apparatus sales office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." General Electric, Schenectady 5, N.Y.

252-66

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
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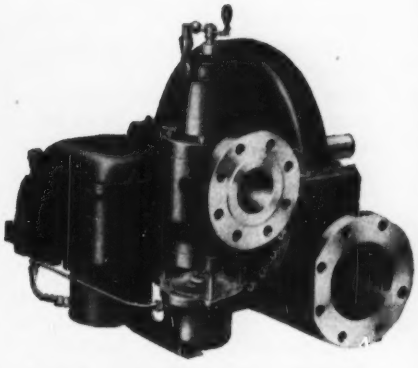

G-E Type DP Mechanical-drive Turbine

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EVALUATE ALL THE COSTS

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Solve broad management problems.

IF YOU CAN . . .

Polish up your old mathematics.
Master several new techniques.

THEN YOU MAY . . .

Carve a new niche for yourself.
Reach the $25,000-a-year bracket.

Build Your Career in Operations Research

She's the new glamour gal of the management world and it looks as if she'll be around for quite awhile. You may have met her under another name or even while she was traveling incognito, but it's a sure bet that you'll be hearing plenty about "Operations Research" in the days ahead.

Actually, when you come right down to it, the principles and practices of operations research are not new (although many of the mathematical tools are) you've probably been using them in your day-to-day work for years. But it's been only since World War II that they've been applied to the broader problems of war and peace.

What Is It?

Want to give an operations research man a tough job? Ask him to define operations research. You'll find that there are about as many definitions as there are people in the field. But they all boil down to something like this:

Operations Research is the application of the scientific method, as exemplified in research, to the complex problems of both military, government and business management.

It's taken the scientific method of research out of the laboratory and into the board room to give top level administrators a quantitative basis for management decisions. Where OR has been intelligently applied it has resulted in a more effective use of available facilities.

How and Where Can It Be Used?

Operations research is simply the carrying on of research at the operations level. Chemical and physical research is carried on at the laboratory level. Engineering research takes place at the development level. Operations research takes place at the company level.

It's all well and good to say that OR can be—and has been—used to solve broad business problems, but what are these problems?

First of all one of the basic business problems lies in getting the salesmen to contact those accounts which are ready to buy at the time at which they are ready to buy. This is essentially the same problem that military OR teams met and solved during the war; the seeking and sinking of enemy submarines—again a problem of being at the right place at the right time.

Another problem that may be plaguing your company is how and where to spend the advertising appropriation for best results. Or perhaps its a production scheduling or an inventory problem that's been giving your firm trouble. In any case, the scientific approach, abetted by the mathematical techniques developed by operations research men, can come up with a better understanding of the facts underlying the problem and will aid management in making its decision.

What It Means to You

Perhaps your reaction to all this talk about operations research can be summed up in the two words "So what?" If it is you may well be missing the boat. For you may be just the guy who can step in and get the answers to these problems.

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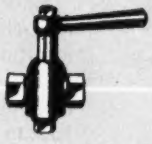

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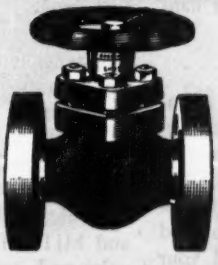

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As an Operations Research Man You Would . . .

1. **Study a situation first-hand to find the true nature of the problem.**
2. **Take available data and statistically sift them for clues to behavior patterns.**
3. **Plan additional experiments if necessary to get new data.**
4. **Determine and evaluate the pertinent facts.**
5. **Construct a mathematical model to portray various effects in their proper relationship.**
6. **Design and construct tests to try the model and to check proper relationship.**
7. **Conduct new tests to determine the optimum conditions.**
8. **Report results and recommendations to management.**

an operations research team? There sure is. A short time ago a list was published [*Fortune*] giving a breakdown by training of the staff members of the Rand Corp., an independent research and development organization set up to aid the Air Force in long range planning. Some 20 percent—the largest single group—of the 433-man staff were engineers.

What Makes an OR Man?

You see, to be an operations research man you don't have to be an expert in business but you do have to be a scientist.

Major requisites are a keen, observent mind, courage to tackle big and tough jobs and a great deal of curiosity. Ideally the OR man combines creative ability, common sense and some understanding of human relations. Technical knowledge of the particular industry involved is not nearly as important as the proper mental and personality characteristics.

This doesn't mean that the fellow who knows his company from A to Z won't make a good operations research man. But it does mean that he'll have to shed any preconceptions of "how things oughta be done around here."

His job will be to gather facts and then to seek the fundamental relationships which lie behind those facts. Once these have been found—and tested—he'll point out to management the results of various courses. And thus, management can make a more intelligent decision.

He'll be doing the same thing that his colleagues in the laboratory are doing except that his problems will be at the operational level and will require a few new techniques for handling the data.

What Training Is Needed?

If you've had a good training in engineering, you've probably already developed that passion—and reverence—for facts that is the hallmark of the scientist. You've also acquired a grounding in math that will be a good foundation on which to build your knowledge of the special techniques of operations research. Now, if you can add a consuming curiosity about the why of company operations, you're all set to begin your indoctrination.

First step is to get your math in working order. Brush up on the calculus.

Maybe it will entail a trip back to school. While you're there take some courses in statistics and in probability theories, learn the basic elements of accounting and economics and also pick up some knowledge of psychology—it will be a big help.

At the same time try to learn as much as possible about all sides of business. Once you've gotten the groundwork you can start learning the special techniques that have been developed to solve operations research problems.

Where to Learn the Techniques

Where to get the necessary information on the techniques of OR can be a bit of a problem—but not an insurmountable one.

Since today's concept of operations research is of such recent vintage, the literature of the subject is severely limited. This, of course, will be remedied in time, but right now you'll have to make do with what's available.

At present there is only one textbook* on the subject. And that was not originally intended to be a textbook. It was first written as a confidential Navy document, but it has recently been released in a revised form, thus making wartime experience available to industry. The examples and problems contained in the book, however, pertain entirely to the military.

Numerous magazine articles have been written on the subject of operations research, but few of these discuss the techniques in any detail. Exceptions are those articles which appear in the *Journal of the Operations Research Society of America*. These articles generally present both case studies and descriptions of the techniques used.†

In addition, several schools currently conduct graduate courses in OR. Among these are; Carnegie Tech, Case Institute, Columbia, Johns Hopkins and MIT. These courses usually involve such subjects as advanced engineering statistics, mathematical forcasting, industrial probability, theory and design of experiments, mathematical models, statistical quality control and linear programming.

Most of these schools also conduct "short courses" in OR at various

* Methods of operations Research by P. M. Morse and G. E. Kimball, John Wiley and Sons, Inc., New York, $4.

† Information about both the Journal and the Operations Research Society can be obtained by writing to the secretary, John B. Lathrop, c/o Arthur D. Little, Inc., 30 Memorial Drive, Cambridge 42, Mass.

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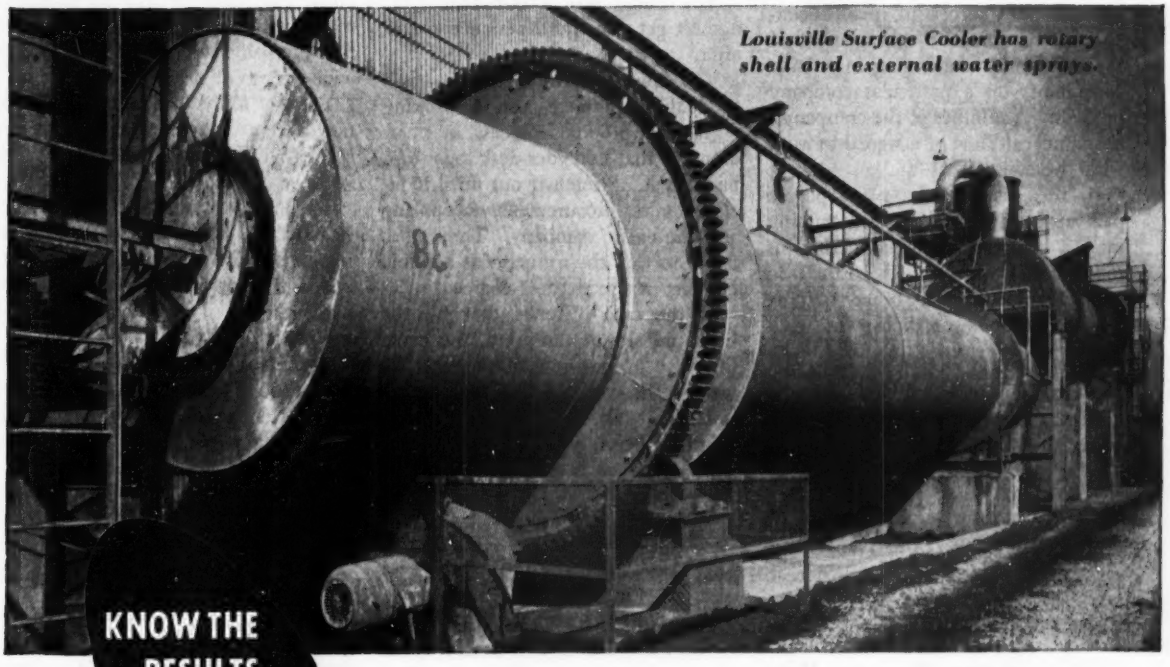

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YOU AND YOUR JOB . . .

"In most of the companies that are using OR, this group occupies a staff position well up on the company organization chart."

times of the year. These afford an excellent opportunity to get acquainted with the new techniques.

Another Way to Learn

One way of learning the ropes that has been quite successful, involves convincing the company management of the desirability of bringing in outside consultants on a particular company problem. A number of the company's personnel can then be assigned to work with the consultant.

In this manner, the plant people pick up both experience and training in OR techniques. This method is most successful when it is used to supplement whatever other training the people obtain on their own.

How to Start

Alright now, let's assume that you've studied the methods of OR and you're ready to use them. If the company you work for already has an OR group you can work your way into it. But if your company, well, doesn't go in for these newfangled notions—then what?

You could quit. But that still doesn't get you the experience you're after.

The thing to do is to take that production problem you're working on, or that proposed process, or whatever it is that's on your desk today and broaden it. Stretch it out until it includes sales, procurement, accounting and the entire company. Then work it out so that the company as a whole benefits in the greatest degree.

If the case histories that fill the literature are any criterion, the benefits that do accrue will probably be well worth while.

It won't take more than one or two solutions before you'll be well on the way to being the operations research group of your company.

What Are the Rewards?

In most companies that are using OR this group occupies a staff position well up on the company organization chart. It acts in an advisory position to one or more decision-making executives.

This post places it in a position from which it can work on broad problems which are of vital concern to the entire company. It puts the group in touch with virtually all segments of the company and presents it with a wide variety of interesting problems.

For the individual there is the opportunity to share in work of a greater scope. He'll meet stimulating and provocative problems.

He'll also do pretty well financially. A good OR man has no trouble commanding $12,000 to $15,000 per year, and a top man is worth from $25,000 up—with some receiving $40,000 and more.

And with the field growing in both size and importance at a rapid rate operations research may be well worth your looking into.

GETTING FIRED

. . . *Some Reasons Why*

Why are people fired from their jobs?

In a study conducted by Harvard University recently it was shown that the employee's inability to do the work was responsible in only 34 percent of the cases investigated.

Two other reasons accounted for nearly all of the remaining cases. These were: an apparent inability to get along with co-workers and a lack of creative imagination.—*Supervision*

GOLDEN YEARS

. . . *The Early Thirties*

Man's usefulness to society has no age limit. But while the typical creative thinker produces valuable work during most of his life and his creativity declines only slightly from its peak, the peak comes early. So reports Harvey C. Lehman in his new book "Age and Achievement."

Mr. Lehman undertook a thorough statistical analysis of the relationship between age and achievement in most of the arts and sciences, even some sports. He has found that in nearly all fields of endeavor peak performance is achieved in the early thirties.

He reports, for example, that most of the really great advances in chemistry were announced by men between the ages of 26 and 34. Inventions are most likely to come from men between 30 to 35. Even Edison, who was active until his 80's, received 28 percent of all his patents between 33 and 36.

An interesting sidelight of Mr. Lehman's study is that the creative peak has steadily been shifting to an earlier age. For example, outstanding physicists born prior to 1785 made their best contributions during their 40's. Those born later did their best work in their 30's.

When it comes to leadership, however, Mr. Lehman has found that greater achievement is more likely after 50.—*Industrial Bulletin of Arthur D. Little, Inc.*

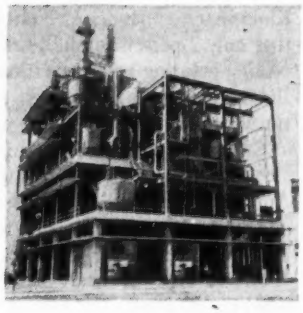
STARTING SALARIES

. . . *Still Climbing*

It's no news that starting salaries for just-out-of-college engineers are still climbing. But when this year's Ch. E. grads are pulling down almost $70 more than those of a year ago, it's worth noting.

The average starting salaries for all January engineering graduates of the Illinois Institute of Technology

CORN AND RUST DON'T MIX



For solid corrosion prevention and vaporsealing tips write us for a reprint of the "Chemical Processing" article mentioned.

Many are the marvelous products made from corn at the Corn Products Refining Company's Bluebonnet Plant. It, too, like other industries in the area, has maintenance problems, for it is situated on the salty coast of Texas with its corrosive atmosphere. An article in "Chemical Processing" for January 1954 revealed that this plant has met its corrosion problem by coating nearly all steel structures and equipment with INSUL-MASTIC.

This same protection can be used in your plant. INSUL-MASTIC's *Superior* heavy asphalt coatings will stop moisture, acids, alkalis and other corrosive agents. They also vaporseal insulation, and a special, cork-filled coating will act as an insulation itself while it prevents rust. Steel mills, chemical plants, refineries and others are using INSUL-MASTIC for lasting protection. It's the rugged, heavy duty guardian of steel and insulation. Let us send you the name of your nearest applicator. Write today.

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reached an all-time high of $373 per month this year–up $32 from last January and $11 from June.

Chemical engineering graduates received the most lucrative offers–the average being $394, as compared to the January, 1953, figure of $327.

Incidently, every graduate who filed for placement left the school with a job.

RETIREMENT

. . . *New Light*

The great majority of aging workers refuse to concede that age 65 marks the end of their useful and productive life. According to records of the Social Security Administration, the average age at which workers begin to collect SS benefits is 69.

At a recent conclave of the American Medical Association a discussion of the subject indicated that the general ideas of retirement at 65 is based upon conditions of 25 and 50 years ago. Medical advances, higher living standards, increased leisure and so on have combined to push man's average life expectancy at 65 to 13 years.

And it is expected that by 1983 the average life expectancy of 65-year old men will have increased to almost 17 years.–*The Controller*

EDUCATION

. . . *Course in Democracy*

When employees of Food Machinery and Chemical Corp.'s San Jose plants indicated a desire, about a year ago, to know more about the "why" and "how" of the American economy, FMC's executives gave them an answer—ten weeks long—in the form of an entirely new kind of employee program. Voted to be honest and successful by an overwhelming majority of those who took it, the course itself and the story behind it are now available in a book, "The Stanford-Food Machinery American Ideals Course," by Dr. Bertrand Klass of Stanford Research Institute.

"Democracy," says the author, manager of SRI's social science research section, "rests on the fundamental belief that people are better off when they think for themselves." FMC, working with Stanford Research Institute and Stanford University Press, believed that the best kind of program would be one in which information and ideas where presented first, then a chance for free discussion.

SRI's role was to test the educational effectiveness of the program as it was developed and to assist in applying the research results to the development of the program.

▶**Attendance Voluntary**–Two presentations were made, one of nine and the other ten two-hour sessions. Employee attendance was in off-the-job time. Three groups attended—production workers, office workers and supervisors. Husbands and wives of employees were also invited. Lecturers and discussion leaders were obtained from Stanford University and from the San Jose Adult Education department.

The sessions themselves consisted of one-hour lecture periods (sometimes with films), followed by brief breaks and then by the "heart of the course"—the discussion sessions. Employees hashed out such questions as "Why did we establish the Constitution of the United States?" "Does a social revolution always involve bloodshed and war?" "How much net profit does industry make?" "Are political parties pressure groups?"

An economist, a union representative, a congressional representative each spoke at the session that was pertinent to his field.

▶**Testing by SRI**–During the progress of the course, Stanford Research Institute, under the direction of Dr. Klass, constantly assessed and evaluated the effectiveness of the program. On the basis of the research results, on-the-spot revisions and changes in program content and procedure were made as the experiment proceeded.

In his description of the course, Dr. Klass includes not only the background of the program, but also lecture and discussion outlines for each session, background reading material in full, evaluation of films, and observations made by SRI during the course.

In the foreword, Paul L. Davies, president of Food Machinery and Chemical Corp. and a member of SRI's board of directors, explains what the program has meant to FMC. He suggests what it can do for other companies or organizations interested in communicating the fundamental economics of our country to employees by demonstrating the relationship that exist between economic, political and social systems.

The course is presented in such a manner that any organization can use it, either without change or by developing it to meet special needs.

So successful has the Stanford-Food Machinery experiment been that a third presentation is now being made to the employees of FMC.

FOR LONG LIFE

. . . *Exercise*

Most "strokes are the result of too much eating and too little physical activity over too many years–not the result of hard work and mental strain." That's the verdict of Dr. Theodore G. Klumpp, president of Winthrop-Sterns Inc. and an authority on longevity.

Speaking to a group of young presidents of American companies, Dr. Klumpp cited studies which showed that only 2 percent of all heart attacks occurred during severe exertion, while almost half happened while the victim was asleep.

Convinced that modern executives are the foremost victims of the "great American neurosis" that hard work and the pressure of great responsibility cause arteriosclerosis, the most common type of heart disease, Dr. Klumpp declared, "It doesn't require much effort to convince panicky businessmen to 'take it easy,' meaning not only less mental exertion but no physical activity at all."

He then pointed out that arteriosclerosis is not the normal and natural process of growing old, but is a metabolic disturbance linked to the presence of cholesterol in the artery lining. "This," he continued, "is encouraged by reduction in physical activity and a gain in weight. Exercise is important for its effect on the body's entire endocrine pattern, and is, therefore, a way to avoid high blood cholesterol."

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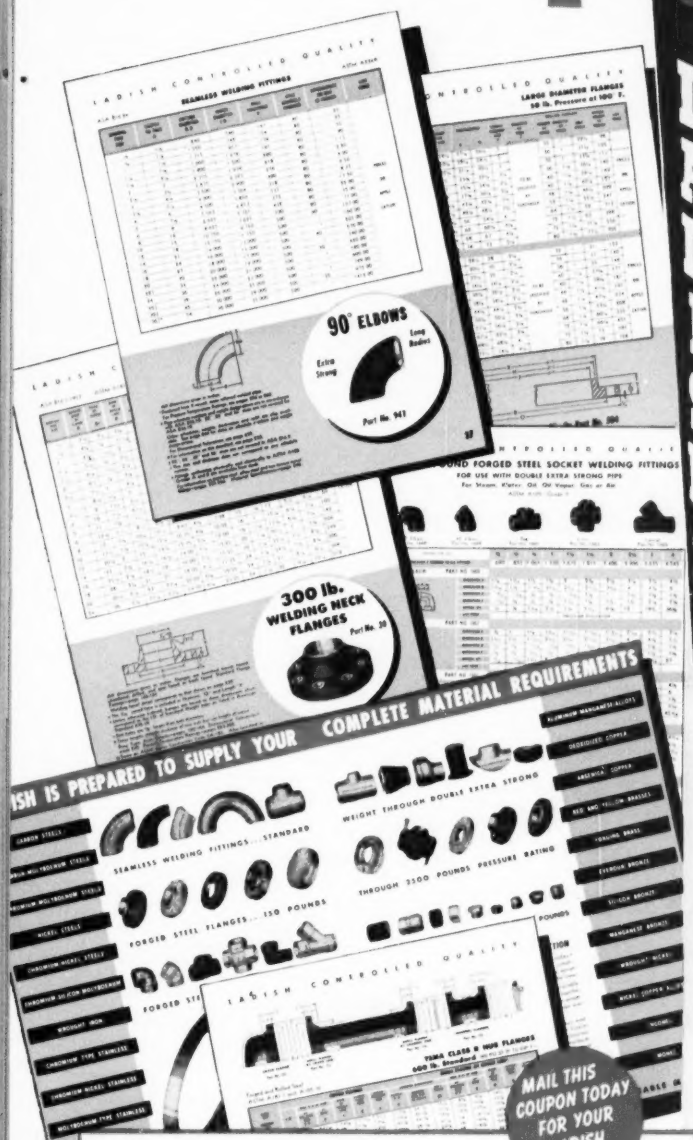

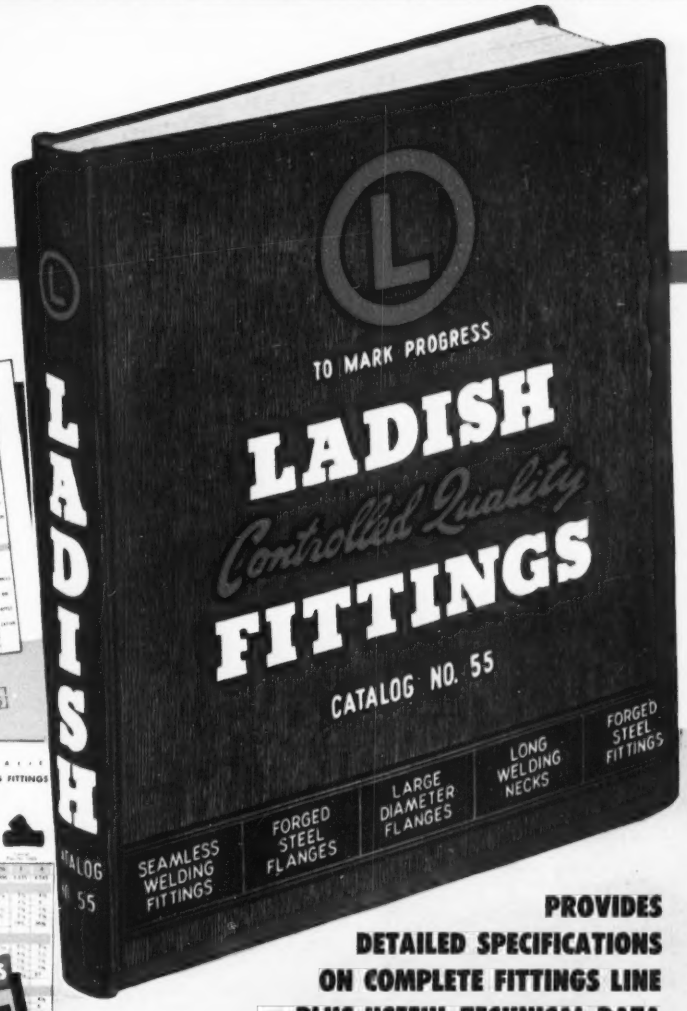

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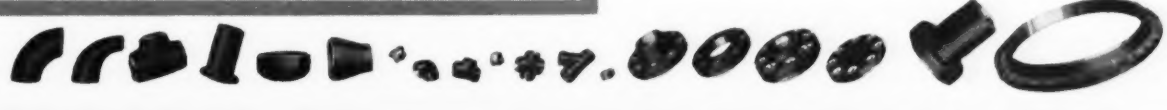

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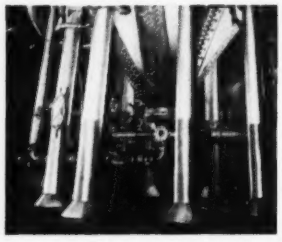
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

What Good Anti-Corrosion Painting Can Do

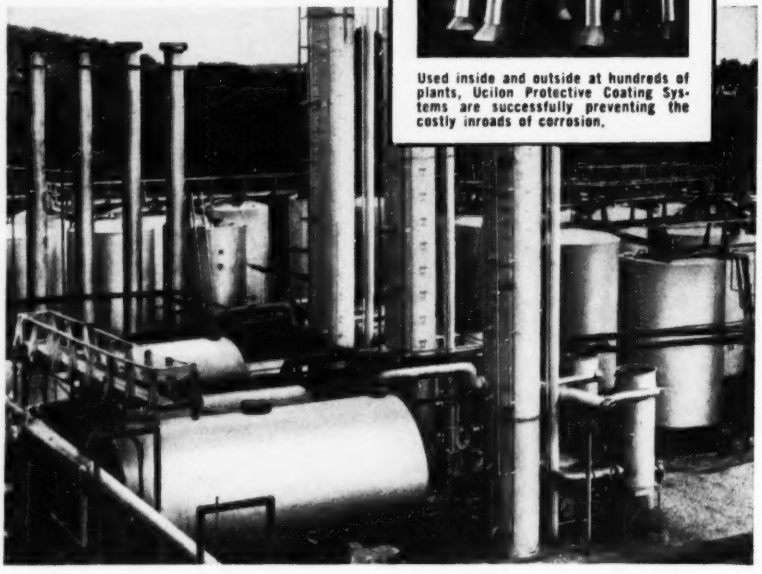
Case histories demonstrate the three benefits of Ucilon Protective Coatings*



Used inside and outside at hundreds of plants, Ucilon Protective Coating Systems are successfully preventing the costly inroads of corrosion.

SUCCESSFUL corrosion control measures mean: (1) longer equipment life and less downtime; (2) less frequent and therefore lower cost maintenance painting; (3) better looking plant and equipment.

Systems of Ucilon Coatings are used far and wide today because actual results *prove* that they assure successful corrosion-control programs. For example:



INCREASED EQUIPMENT LIFE

Large centrifugal pumps moving salt water for a processor had to be replaced every 12 to 18 months because of corrosion. Because impellers had to combat erosion, too, a Unichrome Plastisol Coating 30 mils thick was specified to protect them. Housings, however, got just 5 mils of a* Ucilon Coating System for corrosion resistance. Inspection one year later showed *both* coatings still going strong, and no attack on the pumps.

INCREASED INTERVAL BETWEEN PAINT JOBS

Interiors of brine tanks at one chemical plant were still protected from corrosion 5 years after a Ucilon Coating System had been applied. In another case, 5 years of service were also obtained against hydrochloric acid fumes, and with virtually no patchwork needed.

BETTER LOOKING PLANT

A well known distillery has standardized on a Ucilon 1601 Coating System for protecting outdoor metalwork. It's applied every 2 years. They have found that this aluminum formulation not only prevents rusting but also stays bright and attractive throughout the entire interval.

Many Ucilon Coating Systems have been developed to beat a wide variety of corrosives under various conditions. Bulletin MC-7 contains simple chart to guide you to better control of these corrosives. Write for copy or look it up in "Chemical Engineering Catalog." *Trade Mark

How cast iron replaced stainless steel

The toughness and chemical resistance of special Unichrome Plastisols often permit ordinary steel or cast iron to be used under extremely corrosive conditions in place of stainless. The bigger the part, of course, the bigger the savings.

One company, for example, coated cast iron duplex strainer bodies weighing more than 1250 pounds with a special Unichrome Plastisol Compound and satisfactorily used them where stainless had formerly been needed.

Unichrome Plastisols, producing a thick vinyl coating without porosity, are outstanding for continuous contact with a broad range of strong corrosives. Write for Bulletin VP-1.

DRUM LINING WITH EXTRA ADVANTAGES

To overcome limitations of phenolic-type drum linings for certain applications, United Chromium has developed a superior epoxy-resin coating. This lining not only assures basically the same resistance to acids, oils, solvents and wetting agents as the phenolics, but also provides alkali resistance and greater flexibility and impact resistance.

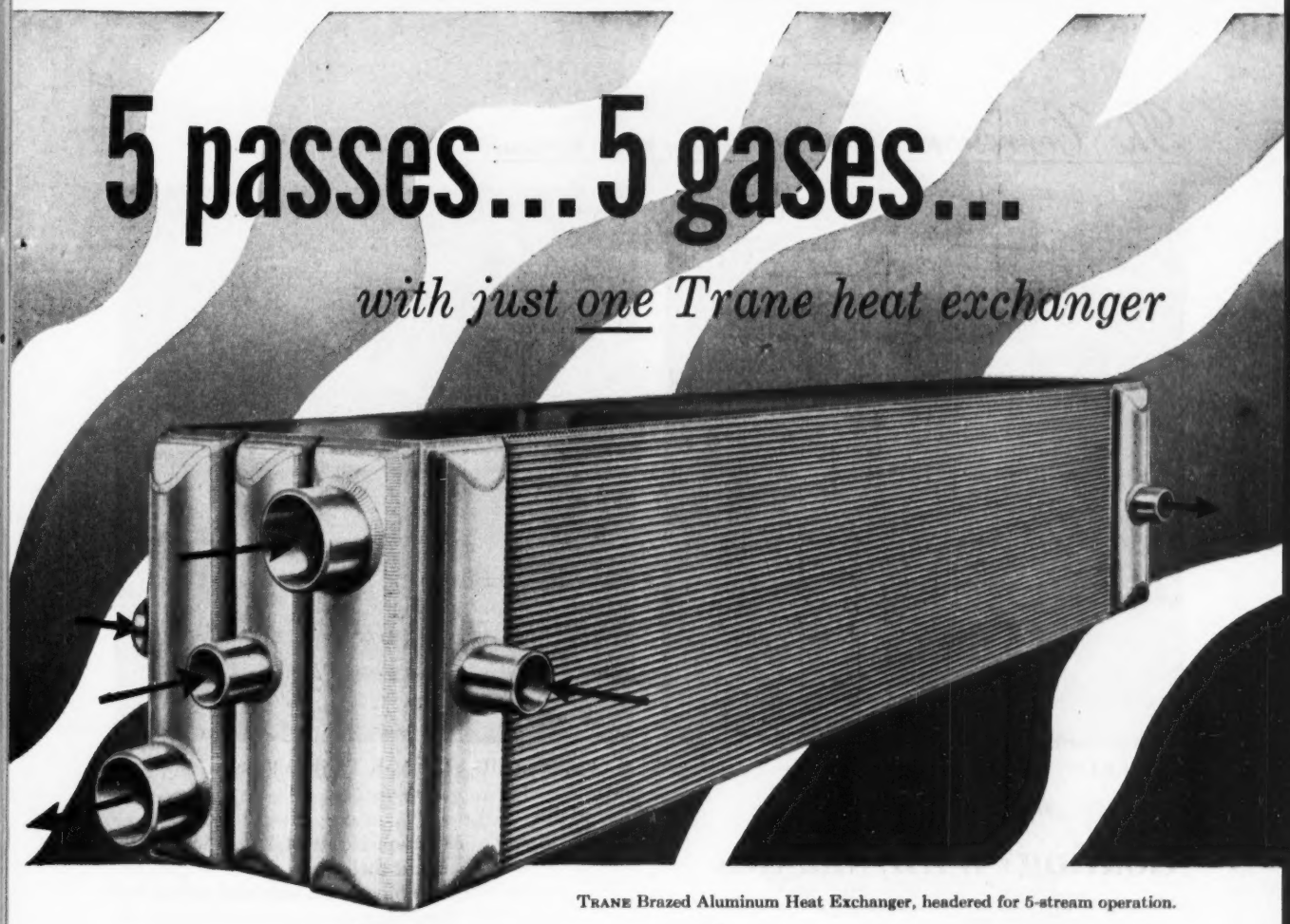
Because of its flexibility and adhesion, it stands impact shocks without cracking or chipping off. Write for more detailed information.

UNITED CHROMIUM, INCORPORATED

100 East 42nd Street, New York 17, N. Y. • Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

5 passes... 5 gases...

with just one Trane heat exchanger



TRANE Brazed Aluminum Heat Exchanger, headered for 5-stream operation.

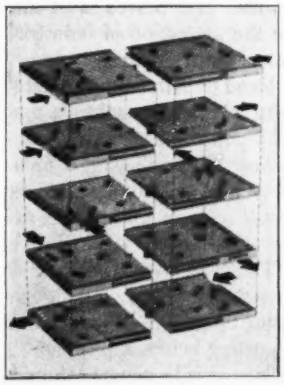
Multi-fluid heat exchanger for large scale process heat transfer saves space, saves cost

The problem of heat transfer between three, four, five or more liquids or gases in process operation can be solved by lighter, more compact, more economical TRANE Brazed Aluminum Heat Exchangers. One multiple-stream TRANE unit has in many instances occupied ⅓ the space at ¼ the weight of conventional heat exchangers, at far less cost . . . making it particularly well suited for processes using multi-stream heat transfer, such as air separation, helium and ethylene recovery. The reason . . .

More efficient heat exchange surface of TRANE brazed aluminum gives you a lighter weight heat exchanger that packs up to 450 sq. ft. of heat transfer surface into one cubic foot, yet operates at pressures up to 500 psig with temperatures as low as —350° F.

Whether your heat exchange problem involves close temperature approach, low temperatures or multi-fluid heat transfer, there is a TRANE Brazed Aluminum Heat Exchanger to fit your needs. Our 30 years' experience in all phases of heat transfer plus our laboratory facilities provide the solution to these problems.

For further information, ask your TRANE Sales Office for a copy of "Extended Surface Heat Transfer Equipment" or write TRANE, La Crosse, Wisconsin.

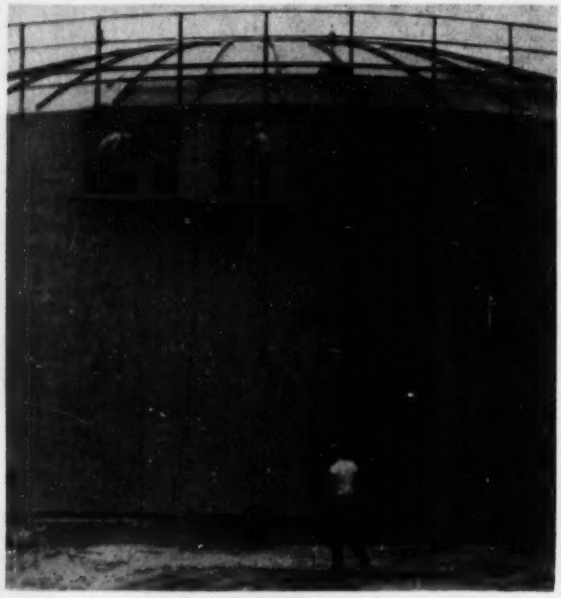


This symbolic drawing shows how one TRANE Brazed Aluminum Heat Exchanger can handle as many as five fluids simultaneously. Compact design simplifies headering. Units are available for cross-flow and counter-flow operation.

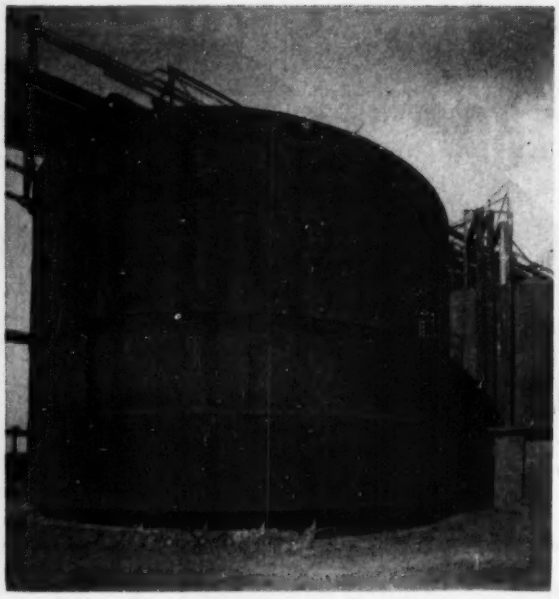
TRANE *brazed aluminum heat transfer surfaces*

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices.



RUBBER-LINED TANK being covered with spray coat of mastic.



SULFURIC ACID STORAGE TANK with heavy spray coat.

Coating With Mastics

Asphaltic mastics are good for protecting your steel against splash and fumes of salts, alkalis and non-oxidizing acids up to 150 deg. F.

RAYMOND B. SEYMOUR & ROBERT H. STEINER
The Atlas Mineral Products Co., Mertztown, Pa.

Mastics, like all other coatings, are subject to limitations. They should be used for the protection of equipment against splash and fumes of corrosives —and not for immersed conditions except in special cases. Service under conditions of immersion should be limited to intermittent exposure with ordinary corrosives and continuous exposure with mild corrosive solutions, such as salt water.

As indicated by the accompanying charts, heavy coatings of properly applied mastics will protect structures and equipment against splash and fumes from salts, alkalis and non-oxidizing acids at temperatures up to 150 deg. F. Products of this type are not recommended for use in the presence of organic solvents, nitric acid, chromic acid, chlorine, sodium hypochlorite or chlorine dioxide.

Mastics are not recommended for continuous contact with liquid concentrated sulfuric acid but are usually satisfactory for exposure to fumes from concentrated sulfuric acid, particularly for outdoor exposure when the mastic serves as a tank coating.

SURFACE PREPARATION

Recognized surface preparation procedures must be used. Otherwise, the heavy mastic coating will merely mask the corrosive effects. There are many instances on record which show that because of inadequate surface preparation, tanks or pipe lines have disappeared leaving a mastic shell. This created hazardous conditions when the liquid content broke through the mastic shell.

All loose mill scale and surface contaminants must be removed from the surface, preferably by sandblasting. The fresh surface must be solvent-cleaned and primed immediately.

Mastics are usually applied in thicknesses varying from $\frac{1}{8}$ to $\frac{3}{8}$ in. as one or two coats using high-pressure spraying equipment. Cork may be present for insulation purposes and granules may be added to the wet coating surface to produce decorative effects. However, the most chemical-resistant mastic coatings have no cork or granules.

COMPOSITION

Mastics that have proved most successful for the protection of industrial equipment against corrosive fumes contain a blend of petroleum and natural asphalts, plasticizers, solvents and fillers. The petroleum asphalt is usually obtained by air-blowing a mid-continent crude. An optimum amount of Utah coal resin or Gilsonite is desirable but an excess will yield a brittle coating. The resin base consisting of Gilsonite, asphalt and plasticizers should constitute 30 to 45 percent of the total coating before application.

The fillers usually consist of mica

TEST THESE Corrosion-Resistant Alloys

. . . and see for yourself how economical they are

The only way you can be sure that a corrosion-resistant material will work in your plant is to test it under actual operating conditions. Laboratory tests will give you some idea of what to expect, but they don't show the effects of the variables involved in production operations. That is why we have prepared standard test specimens of HASTELLOY nickel-base alloys . . . and they are available to you without cost.

Test these alloys yourself against the materials you are now using, or against others that you are considering using. Prove to yourself that they have exceptional corrosion resistance . . . high mechanical strength, even at elevated temperatures . . . and that they are economical to use. We can support these claims with records of laboratory tests and with case histories of actual installations in chemical, petroleum, textile, and metalworking plants over the past 20 years. But don't take our word for it—see for yourself.

Use the handy coupon below to order your samples of HASTELLOY alloys. Alloys B, C, and F are available in either cast or wrought forms, while alloy D is supplied as castings only. If the equipment you have in mind is to contain welded joints, be sure to advise us, so that we may furnish you with welded samples.

"Haynes" and "Hastelloy" are registered trade-marks of Union Carbide and Carbon Corporation.

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HAYNES Trade-Mark *alloys*

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☐ B	☐ C	☐ D	☐ F	☐ B	☐ C	☐ F

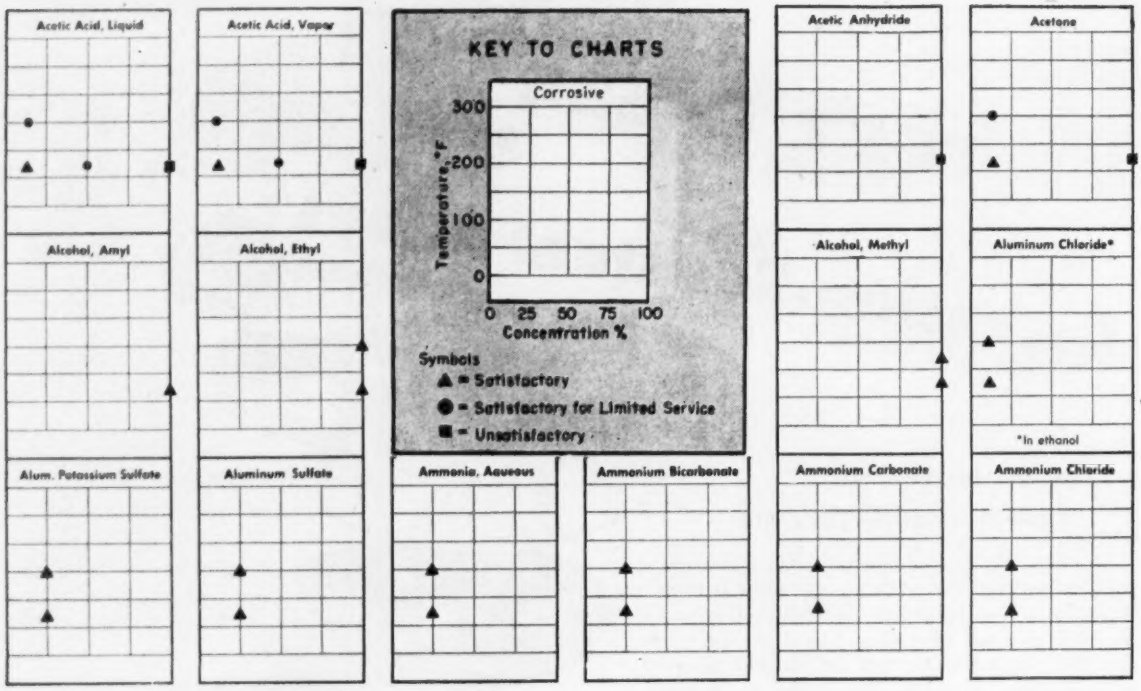
☐ Above samples should have welded joints.

NAME_____

COMPANY_____

ADDRESS_____

Corrosion Resistance of Asphaltic Mastics . . .



with small amounts of clay and asbestos. The total resin and filler content should be 65 to 75 percent of the mastic before application. The coating should not slide or flow when applied as a thick coat to a properly prepared vertical surface.

The solvent which accounts for 25 to 35 percent of the material before application should be a blend of petroleum hydrocarbons. The viscosity of the mastic will vary between 300,000 and 450,000 cps. at 77 deg. F.

APPLICATIONS

While even properly-applied quality mastics will not meet many of the claims proposed by over-zealous advertising agents, they have a definite place in the chemical process industry. Their usefulness for the protection of the exteriors of storage tanks, reaction towers, structures and equipment in paper mills, textile plants, oil refineries, steel mills and chemical plants is based on the entire system and not on any specific ingredients. Successful performance over a period exceeding ten years has proved to be a function of product quality, surface preparation and application techniques.

Ability of mastics to withstand specific concentrations of chemicals at various temperatures is demonstrated by test data in the accompanying charts and case histories as indicated by the photographs. However, as in the case of other metallic and nonmetallic materials recommended for protection against corrosives, this information should be used primarily for screening purposes. Suitable recommendations for the solution of specific problems can be made only by those having expert knowledge of the materials and the conditions anticipated in service.

EXPLANATION OF RATINGS

Test data presented graphically on the following charts were obtained from actual immersion tests even though asphaltic mastics are not normally recommended for this type of service. This type of test is far more severe and the results are more reproducible than when exposure to simulated corrosive atmospheres is used. The symbols used are explained at the beginning of the graph section. Wherever the triangle symbol (satisfactory) appears, the mastic is also considered satisfactory for all milder conditions of temperature and concentration.

INDEX

For your information and convenience, here is a tabulation of the materials of construction which have been covered thus far in the current Corrosion Forum series:

Aluminum	May 1952
Asphaltic Mastics	May 1954
Carbon & Graphite	Sept. 1953
Cast High Alloys	Oct. 1953
Chlorimet 2	Feb. 1954
Chlorimet 3	Mar. 1954
Durimet 20—Carpenter 20	Dec. 1953
Epoxies	Apr. 1954
Furane Cements	Dec. 1951
Glassed Steel	Mar. 1953
Hastelloys C, B & D	June-Aug. 1952
High Impact Styrene	Jan. 1953
High Silicon Iron	Jan. 1954
Lead & Lead Alloys	Feb. 1953
Phenolic Cements	Jan. 1952
Polyethylene	Oct. 1952
Reinforced Polyesters	Dec. 1952
Silicate Cements	Mar. 1952
Stainless Steels	Apr.-Aug. 1953
Sulphur Cements	Feb. 1952
Tantalum	Apr. 1952
Unplasticized PVC	Nov. 1952
Worthite	Nov. 1953
Zirconium	Sept. 1953

Reprints of most of the above are available at 50 c. each. (Hastelloys and Stainless steels, 75 c. each.) Address Reprint Dept., Chemical Engineering, 330 W. 42 St., New York 36, N. Y.

DURCOPUMPS resist corrosion in electrolytic tinplate production at . . .

There are thirty-six Durcopumps on this Number 4 line at Weirton. Durcopumps are available in twelve standard alloys to supply heads to 240 feet and capacities to 2000 G.P.M.

Weirton Steel Company

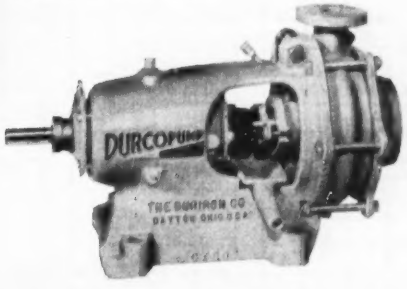
Weirton, West Virginia

Division of National Steel Corporation

Durcopumps handle the severely corrosive tin plating solutions at Weirton. These DuPont halogen solutions with low pH and containing fluorides are continuously circulated from collecting tanks to plating trays by Durimet 20 Durcopumps, which are completely insulated from stray currents. Weirton also uses Durco transfer pumps, filter pumps and sludge pumps.

Weirton Steel Company, division of National Steel Corporation, operates the world's largest single tin mill. The strip on the lines moves as fast as 2000 feet per minute. An example of Weirton thoroughness is the ability to plate a different thickness on each side of the strip to best meet customer requirements.

Durco products have been the answer to thousands of tough chemical service problems. Maybe we can solve yours. Write for Catalog 54 or call the Durco engineer in your area.



DURCO
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THE DURIRON COMPANY, INC., DAYTON, OHIO

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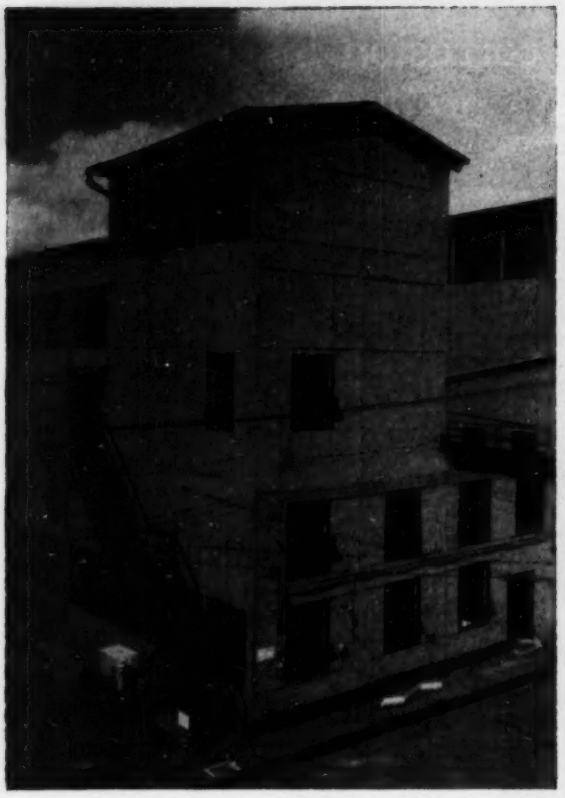
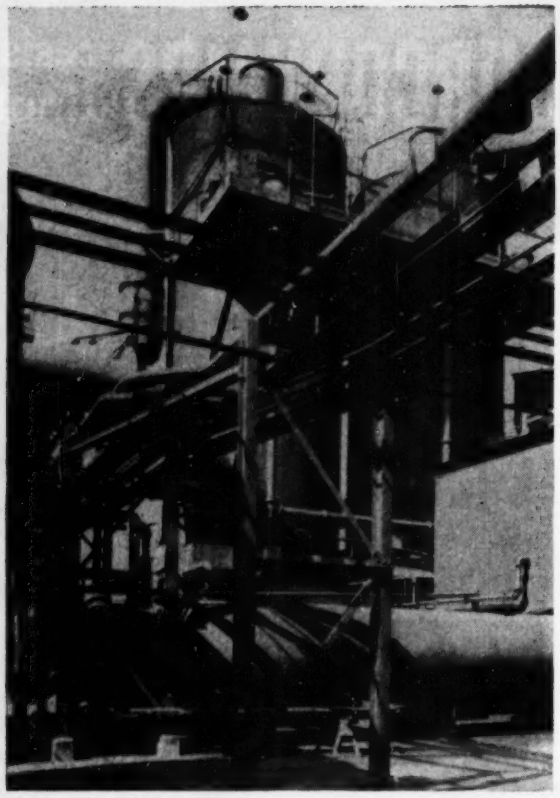
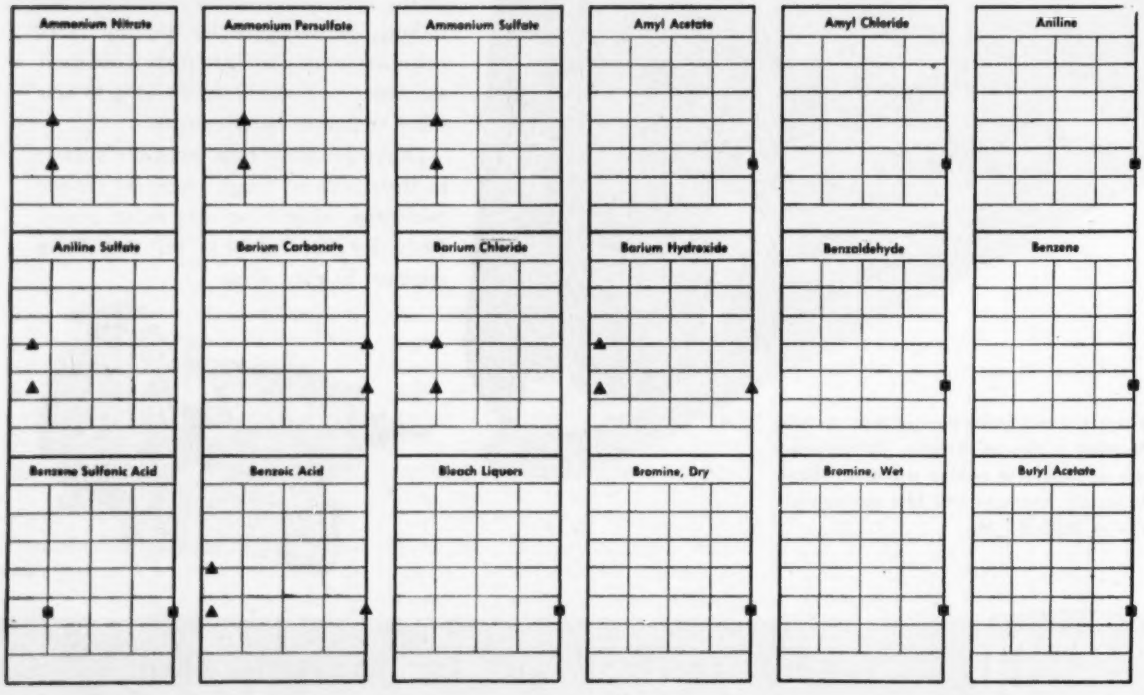


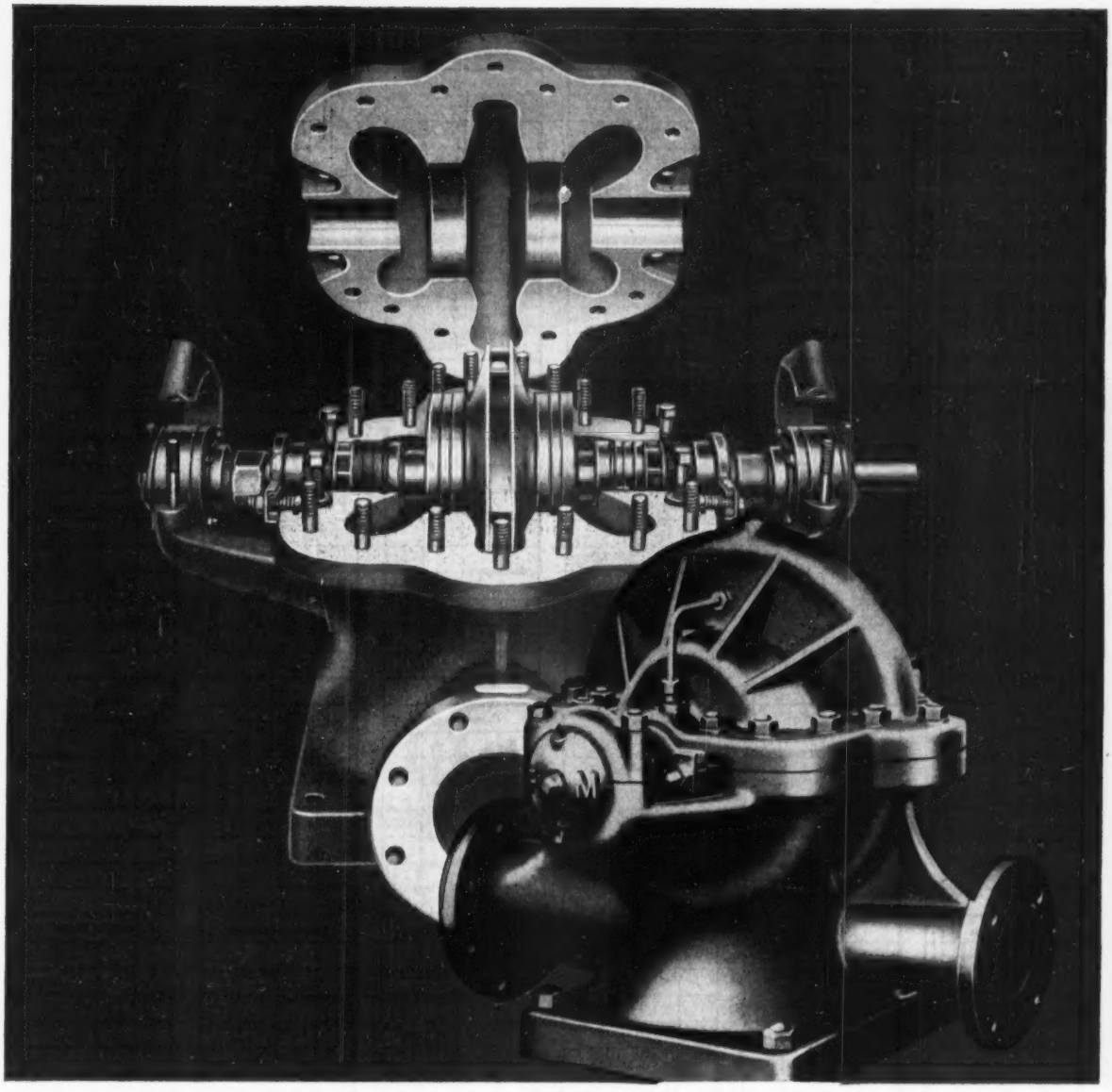
PIGMENT BLDG. coated with mastic with embedded granules.



COTTRELL TOWERS and tanks in acid plant, mastic coated.

Corrosion Resistance of Asphaltic Mastics, *cont.* . . .





out of the mouth of a pump...

Suppose a pump could "spill its works" . . . tell you how it was made . . . speak of the design, material, workmanship that went into its being . . . then you could know . . . and buy with confidence.

Because after all, pumps do look very much alike. How, then, to tell which make is best for you. *Reputation* is one way, *performance* another.

And, on both counts, Fairbanks-Morse pumps stand out. Don't take our word for it. Check with Fairbanks-Morse users. We'll stand by their verdict. For Fairbanks-Morse has only one standard . . . *quality* . . . the quality that means dependability, service, low maintenance, all those important points that you want in the pumps you buy.

To get these advantages in your pumps, rely on the world's largest manufacturer of a complete pump line. See your nearest Fairbanks-Morse Branch, pump dealer, or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

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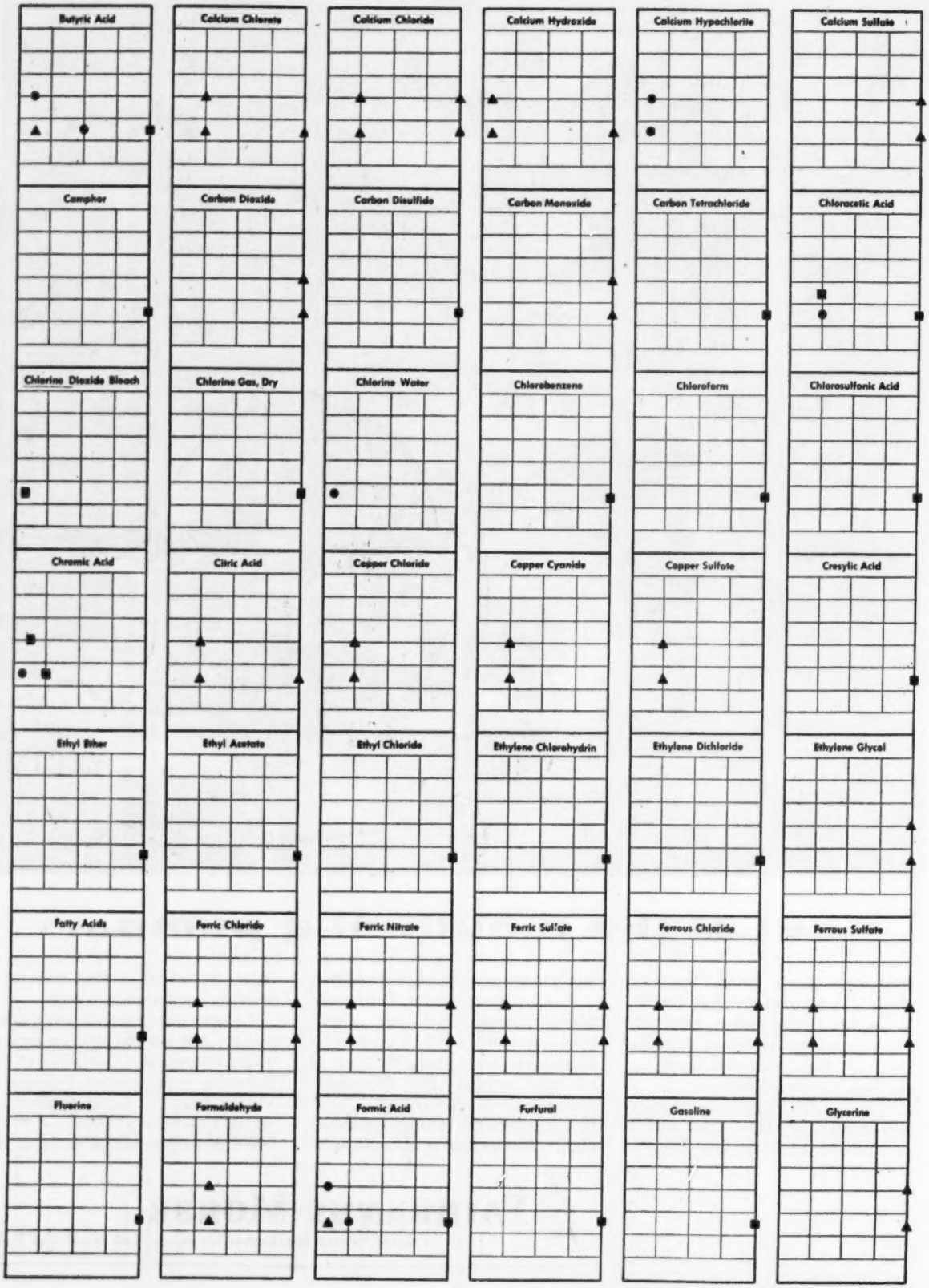
Corrosion Resistance of Asphaltic Mastics, *cont* . . .



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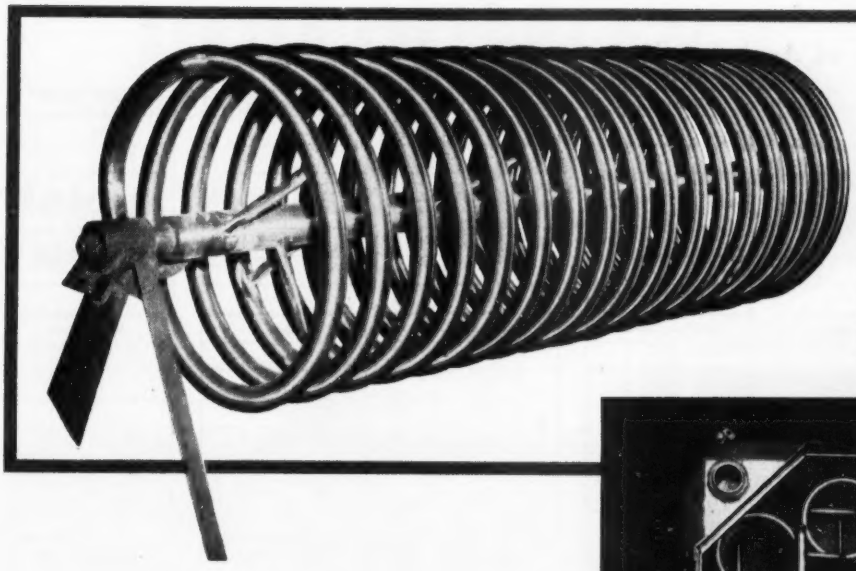
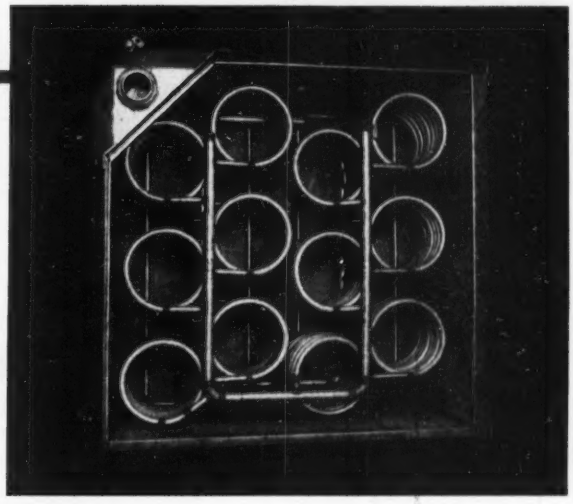


Sanitary applications include coils for cream heaters and coolers fabricated by The Creamery Package Mfg. Company.

One of five superimposed trays in 7,500 pound per hour Votator Semi-Continuous deodorizer for processing oils. Cooling or heating coils and trays are made of stainless steel. Manufactured by The Girdler Company.



How's this for *Bendability?*

When stainless steel tubing, or pipe, is easy to coil, you can avoid a lot of production headaches.

That's one big reason why manufacturers like The Girdler Company, makers of heavy industrial equipment, and The Creamery Package Company, makers of dairy and food processing equipment use ELECTRUNITE Stainless Steel Tubing and Pipe. It's uniformly ductile, easily workable. The result: smooth, accurate coils.

There are other advantages, too. Wall thickness is uniform. So are diameter, concentricity and strength. And ELECTRUNITE Tubing or Pipe meets any one of the following ASTM Specifications: A-249, A-269, A-270, A-312 in Stainless Steel analyses. It's also made to meet many customer specifications.

Ductility of ELECTRUNITE Tubing and Pipe is assured by full annealing. Made from steel produced in Republic's own mills, ELECTRUNITE is quality-controlled from ore to finished product.

Before you consider new equipment, or replacements, get all the facts about ELECTRUNITE Stainless Steel Tubing and Pipe. Write for CEC-54.

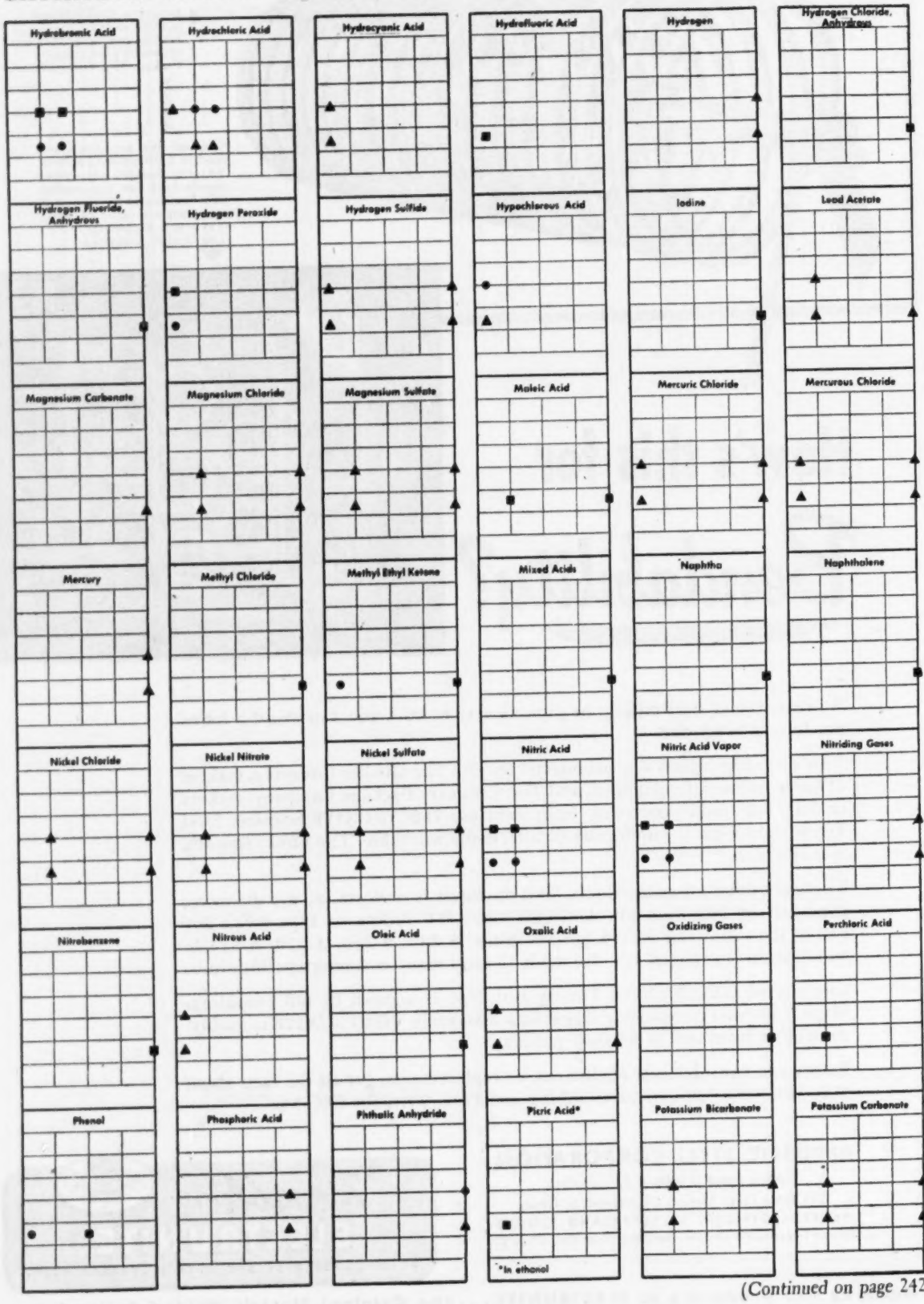
REPUBLIC STEEL CORPORATION
Steel and Tubes Division
203 East 131st Street, Cleveland 8, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

REPUBLIC STEEL

ELECTRUNITE

Made by the producers of ELECTRUNITE...The Original Electric Welded Boiler Tube

Corrosion Resistance of Asphaltic Mastics, *cont* . . .



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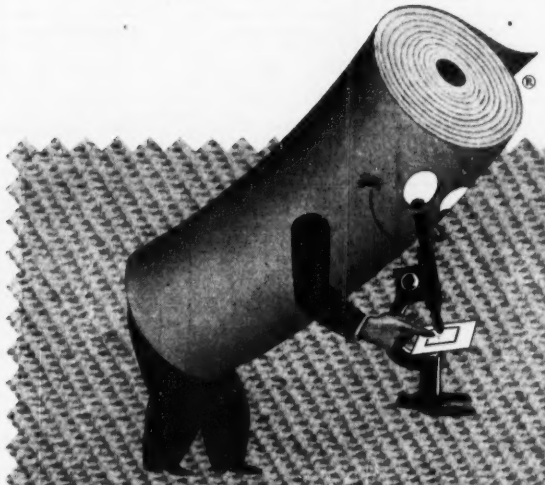
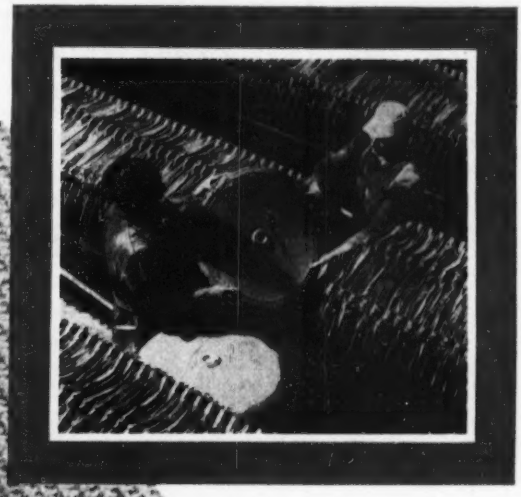
Makes The Big Difference In FILTER FABRICS





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Checking evenness of roving with Belger Tester. One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

FABRICS ENGINEERED TO FIT YOUR NEEDS

Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric – cotton, synthetic or blend – to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

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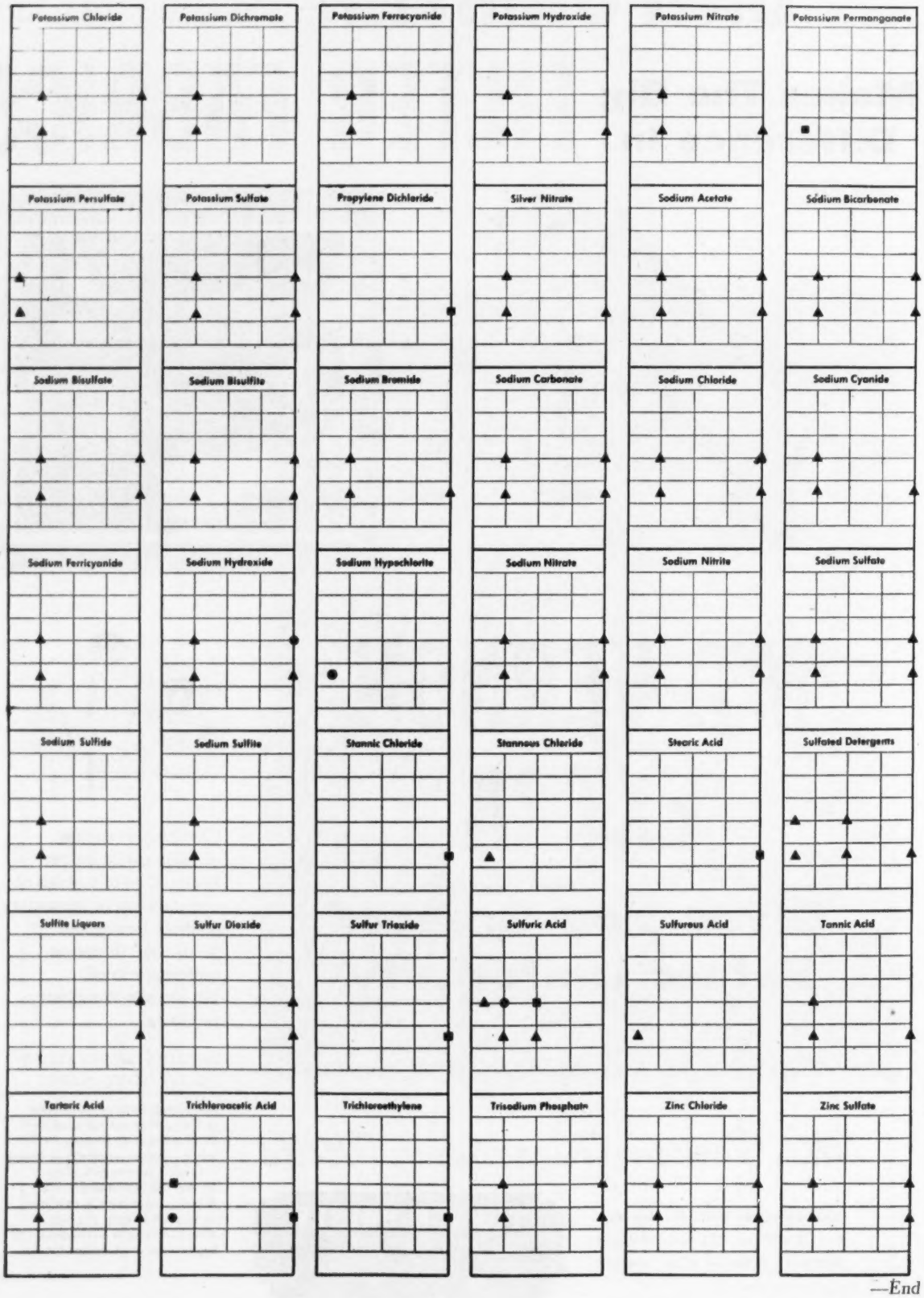
Corrosion Resistance of Asphaltic Mastics *Cont.* . . .



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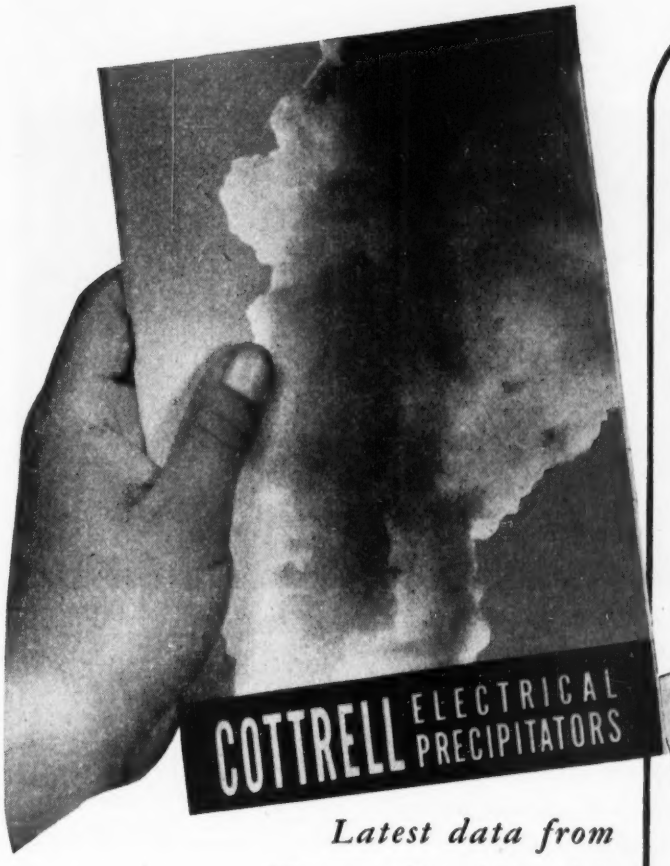

40 PAGES of helpful information

on Recovering Dusts, Fly Ash, Mists, Fumes and other Suspensions from Gases.

This booklet summarizes

the important points design and plant engineers should know about Cottrell Precipitators . . .

- Basic types of Cottrell equipment.
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- Data on Mechanical and Electronic Rectifiers.
- Various types of Collecting Electrodes (rod curtains, corrugated plates, pocket electrodes, etc.).
- Typical ways of removing collected material.
- Various Shell Constructions (steel, concrete, brick, etc.).
- The effect of various factors on efficiency and performance.
- Data on CMP (Combination Multiclone-Precipitator) Units.

. . . and many other helpful facts on Cottrell design and operation.

Latest data from Western Precipitation on Cottrell Recovery Equipment

Do you have operations in your plant where gas-laden suspensions, wet or dry, are a problem? Such suspensions may be dropping on surrounding property, causing nuisance difficulties. Or perhaps important values are being lost in stack gases that can be profitably recovered. Whatever the nature of your recovery requirements, you will find this 40-page Cottrell booklet of great help. It contains up-to-date data on the latest advancements in the electrical precipitation field – prepared by the organization that pioneered the commercial application of Cottrell Electrical Precipitators almost a half century ago and has consistently led in new Cottrell developments.

A copy of this data-packed booklet will be sent free to engineers and other executives interested in recovery processes. Send your request to our nearest office.

For nearly 50 years Western Precipitation has carried on a continuous research and development program on Cottrell Electrical Precipitators, Multiclone Mechanical Collectors and other types of recovery equipment. We are not affiliated with any other company in the electrical precipitation field except our wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. We are equipped to serve you anywhere in the United States, Canada, and throughout the world!

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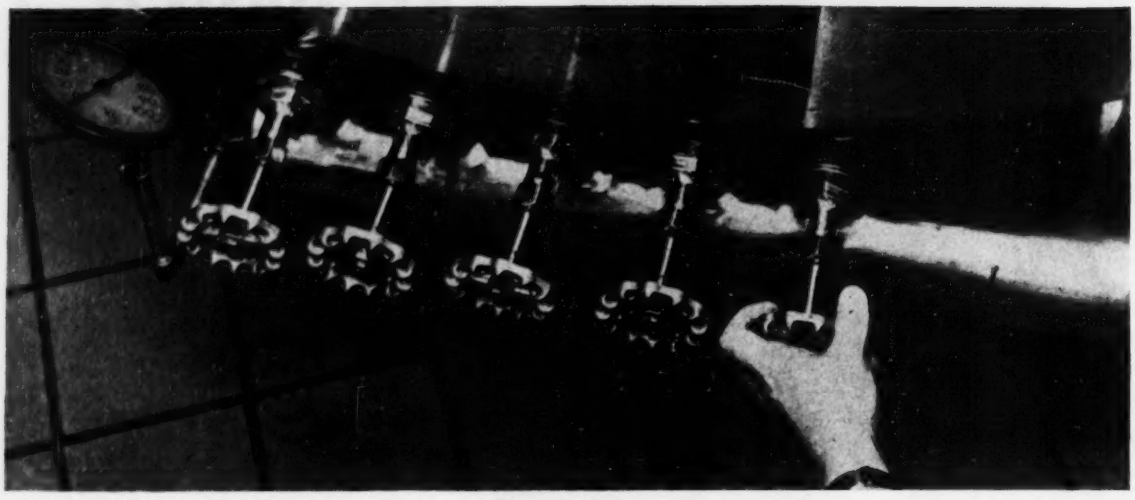


CF-8M MANIFOLD VALVES used in production of Terramycin.

Castings Play Vital Role In Antibiotics

High alloy castings used in production of Terramycin, chloromycetin and penicillin safeguard product purity while standing up to high temperatures and pressures.

E. A. SCHOEFER, Exec. Vice President, Alloy Casting Institute

NOTE: For a comprehensive survey of the use of high alloy castings in the chemical process industries, see *Corrosion Forum*, Oct. 1953.—*Editor.*

Recent disclosures of the operating procedures of many pharmaceutical companies producing antibiotics now reveal that cast stainless alloy components are playing a vital role in this industry. The spectacular transition from laboratory to large-scale production of anticiotics was well publicized, —but not the construction materials that made it possible.

The very important factor of purity enters into pharmaceutical production, in addition to the severe conditions of temperature, pressure and corrosion found generally in the chemical process industries. In many processes, even 1 ppm. of a corrosion product would ruin an entire production run. Problems of purity became particularly appreciable when war demands for antibiotics forced the pharmaceutical industry to change from small laboratory type operation to large production comparable to the heavy industrial chemicals industry.

It is one thing to produce a chemically pure material under ideal laboratory conditions, using glass equipment, and quite another to achieve the same chemical purity continuously, with the concomitant pressures and temperatures necessary for high volume production. Fortunately, engineers had available to them the corrosion resistant stainless alloys.

As pumps, valves, fittings, mixers and the like, cast stainless alloys contributed much to the successful solution of transition problems. It is quite likely that without the availability of these strong, rugged, corrosion-resistant cast components, large-volume production of antibiotics and other modern pharmaceutical products would not have been possible.

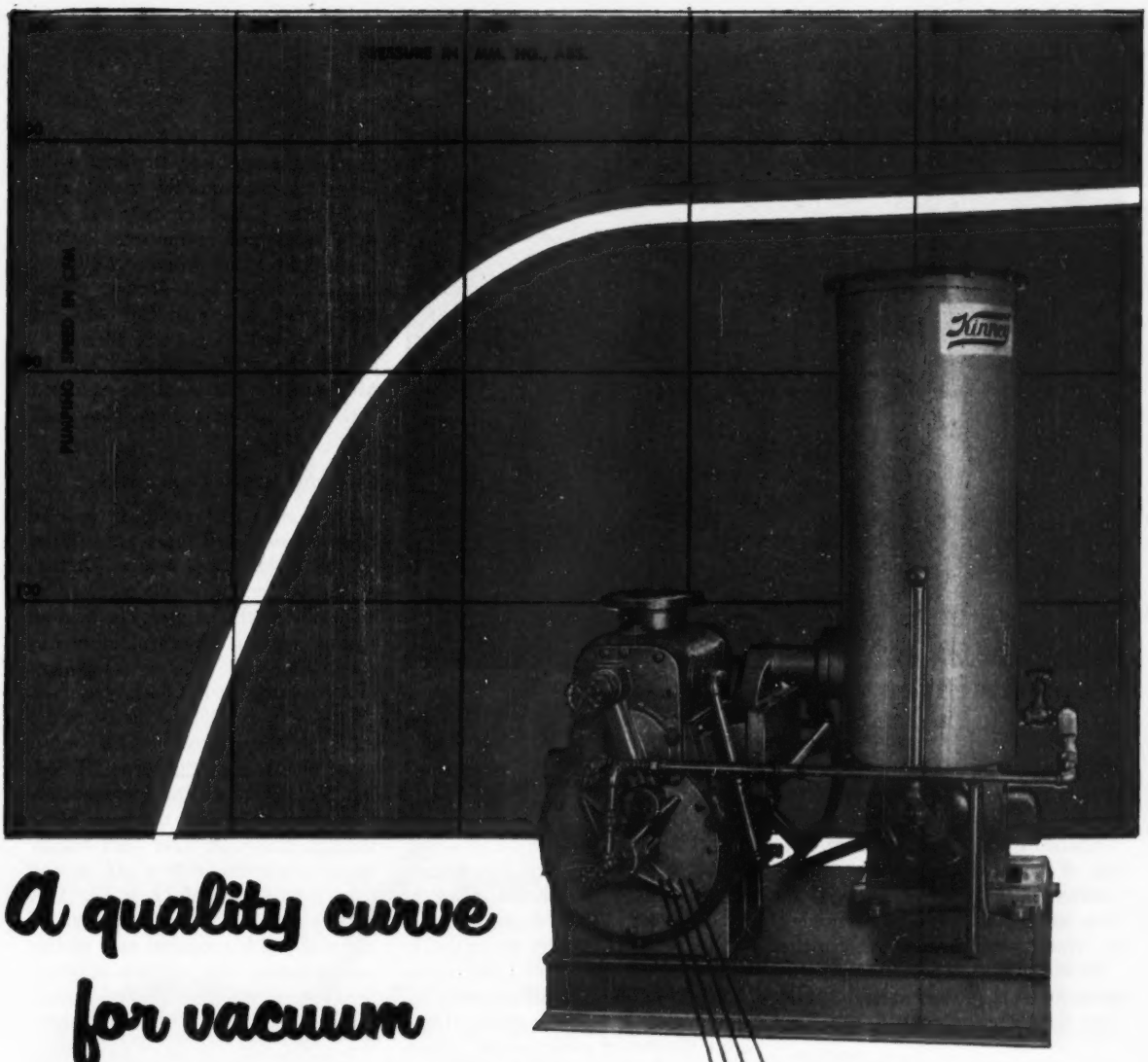
From the group of alloys offering a wide range of corrosion resistant properties, the cast austenitic chromium-nickel types containing 19 percent Cr-9 percent Ni have been frequently chosen for antibiotic process equipment because of their strength, ductility and fabricating qualities.

Shown in the accompanying table are five standard modifications of this general class identified by Alloy Casting Institute symbols. The CF-8 and CF-20 alloys are applied mainly in acid solutions which are strongly oxidizing. Both weak and concentrated alkaline solutions also are resisted by these grades. Where welding is involved, columbium-containing type CF-8C is used to avoid susceptibility to intergranular corrosion. Selenium addition (type CF-16F) confers improved machinability. The addition of molybdenum to CF-8M improves its resistance to reducing chemicals.

The following specific examples illustrate the versatility of these cast alloys in meeting the requirements of service in critical operations.

Penicillin Production

In expanding its production of penicillin, E. R. Squibb and Sons, one of the largest producers, made a basic decision to employ automatic control instrumentation as much as possible at their New Brunswick, N. J., plant. Production here was formerly controlled almost completely with simple indicating instruments and hand operated valves. To increase yields and to improve product quality by closer



A quality curve for vacuum

Here's the performance curve for the Kinney 311 cubic foot vacuum pump — *Model DVD 14.9.18.* Where high, fast vacuum is needed . . . in lamp works, power plants, cable impregnating operations, altitude chambers, coaters, and hundreds of other applications . . . this is the pump to pick. Model DVD 14.9.18 maintains high pumping speed in the low absolute pressure ranges . . . the reason why leading process companies depend on this vacuum pump for reliable, efficient operation.

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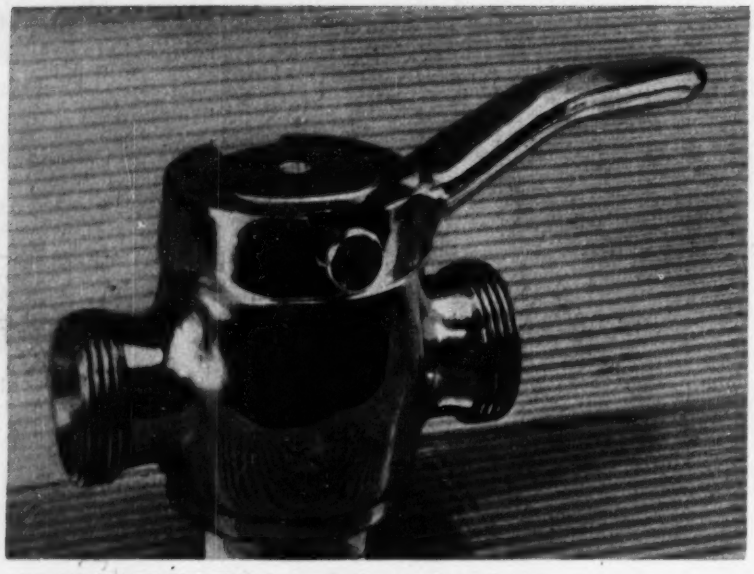


CF-8 SANITARY FITTING for use in Terramycin production.

control of process variables than possible manually, Squibb turned to the Fischer and Porter Co., for special "Flowraters" utilizing high alloy castings of the CF-8M type as important features of the design. The CF-8M alloy was chosen mainly for resistance to concentrated sulfuric and caustics.

In addition to these corrodents, the metering devices and valves had to resist the following agents:

Fluid	Operating Temperature, Deg. F.
Chloroform	50 to 70
Distilled water	70
Fresh butter solution	70
Penicillin broth	50 to 70
Amyl acetate	70
Wetting agent	50 to 70
Sulfuric acid, 98%	120
Potassium hydroxide, 15%	50 to 70
Sodium hydroxide, 15%	100

Not only have these high alloy parts provided more than average service in resisting such corrosives, they have also successfully maintained purity of the penicillin broth.

Terramycin Production

Use of high alloy cast components at the Chas Pfizer & Co. plant in Brooklyn, world's largest manufacturer of Terramycin, involves resistance to dilute sulfuric acid and other corrosives, as well as to sterilization at frequent intervals with live steam. There are a number of points in the process where cast components are employed. For example, tank valves used at the bottom of holding tanks and plug valves in the line are cast of CF-8 and CF-8M type alloys for the Tri-Clover Machine Co. of Kenosha, Wis., supplier of the valves.

Avoiding contamination in these applications is important; but resistance of the equipment to sterilization poses an additional problem. After each batch is run, all lines are completely disassembled, sterilized with live steam and quickly cooled with cold water. Ease of cleaning and ability to withstand temperature cycling in sterilization are prime requisites of the cast valves and fittings. Pfizer uses a wide variety of tank and line valves, as well as sanitary fittings to handle the sterile processing liquids. Most tanks in the plant are equipped with one or more high alloy cast valves.

Chloromycetin Production

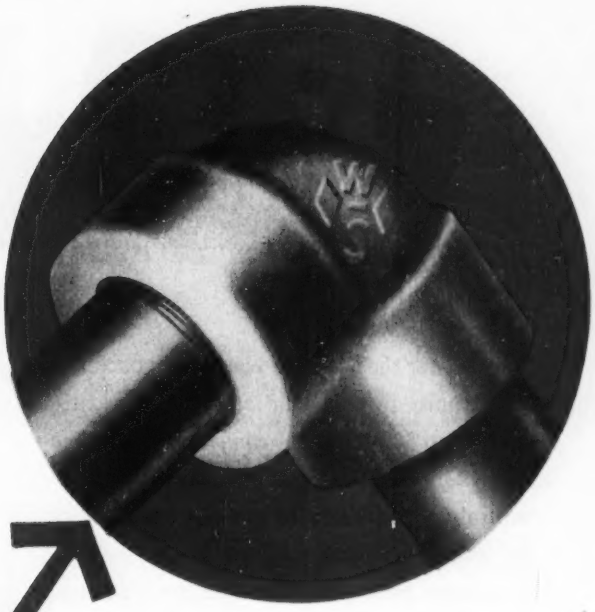
High alloy cast valves in a wide range of sizes and types are utilized by the Parke, Davis & Co., Detroit, in the production of Chloromycetin, an antibiotic that is useful in treating typhus, typhoid fever and other diseases. One cast stainless component of special interest is a flush-type stainless valve on a 1,000-gal. kettle in the chemical department. This valve, made of cast high alloy type CF-8M, has been in service for approximately four years. Chloride solutions going through this valve have been mainly basic in reaction, with a pH ranging from 6 to a high of 12 or 13. This particular valve has not been out of the tank and has required only routine maintenance. The chloride solutions are at vacuum or atmospheric pressure, and are used in a temperature range 0-120 deg. C.

Cast stainless fittings of the same composition are used throughout the "sanitary" lines at the Parke, Davis plant. The temperatures of materials going through these lines range from 0 to 250 deg. F. and the pressure ranges from atmospheric up to 80 psi. Here again, resistance to corrosion with its corollary attribute—prevention of fluid contamination—is maintained by the high alloy cast components.

Standard Designations and Chemical Composition Ranges for Cast Corrosion Resistant "18-8" Alloys

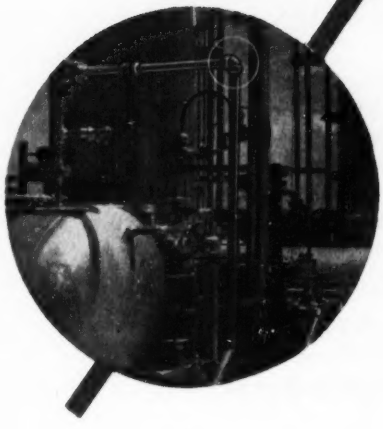
Cast Alloy Designation	Wrought Alloy Type*	Composition, Percent							
		C, Max.	Mn, Max.	Si, Max.	P, Max.	S, Max.	Cr	Ni	Other Elements
CF-8	304	0.08	1.50	2.00	0.04	0.04	18-21	8-11	—
CF-20	302	0.20	1.50	2.00	0.04	0.04	18-21	8-11	—
CF-8M	316	0.08	1.50	1.50	0.04	0.04	18-21	9-12	Mo 2.0-3.0
CF-8C	347	0.08	1.50	2.00	0.04	0.04	18-21	9-12	Cb 8×C min., 1.0 max., or Cb-Ta 10×C min., 1.35 max.
CF-16F	303	0.16	1.50	2.00	0.17	0.04	18-21	9-12	Mo 1.5 max., Se 0.20-0.35

*Note: Wrought alloy type numbers are listed only for the convenience of those who want to determine corresponding wrought and cast grades. Because the cast alloy chemical composition ranges *are not the same* as the wrought composition ranges, buyers should use cast alloy designations for identification of castings.



CLOSE-UP VIEW of a HIGH SAFETY FACTOR

Against Costly Piping Failures



In power plants, chemical plants, refineries and other systems operating at high pressures and temperatures, W-S Forged Steel Fittings help protect the large investment in operating equipment. They provide a high safety factor against costly piping failures and plant down-time. They're drop-forged for *high strength* and *toughness*—the right combination of properties to withstand pressure, heat, shock, vibration and erosion. They're designed for extra strength, too—with extra heavy sections where you need them. And they're precision machined for perfect alignment.

Make Watson-Stillman Forged Steel Fittings your standard for safe, reliable operation of plant equipment. To suit any service and fabrication requirements, W-S Fittings are available in both Screw-End and Socket-Welding types in carbon, stainless and alloy steels. Write today for informative bulletins.

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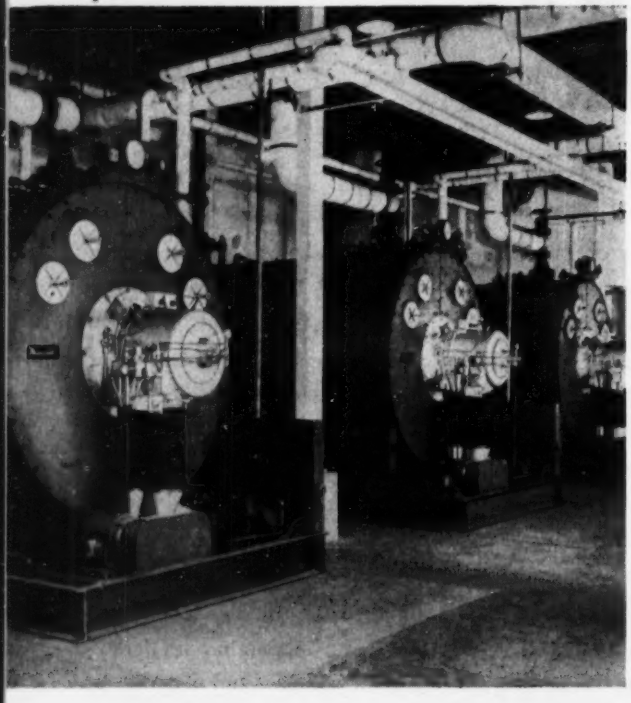
Now . . . for the *first time* you can get packaged boiler units in the wide range of capacities from 15 to 500 HP, with *complete interchangeability of fuels* . . . light or heavy fuel oil—natural or manufactured gas—or combination gas and oil . . . and you get this cost-saving advantage *only* with *Powermaster* Packaged Automatic Boilers. Find out more about this new, wide-range service today from your *Powermaster* representative. He will help you with recommendations and suggestions for selecting the most economical units to supply steam or hot water requirements in any kind of service—industrial plants, institutions, public buildings, schools, laundries, apartment houses, hospitals, dairies, motels, and shopping centers.



Model 3 *Powermaster*—Experienced-proved to be the standard of industry. These three 350 HP units are supplying process steam at pressures up to 200 psi. with rapid response to load changes.

- Complete Fuel Flexibility:
  Light or Heavy Oil, Any Gas or Combination Oil and Gas.
- Choice of:
  Air Atomizing VORIFLOW Oil Burner —Pre-Mix VORIFLOW Gas Burner— Combination VORIFLOW Oil and Gas Burner—All Designed and Built by O & S.
- Full-Range Modulation with VORIFLOW Combustion.
- All Middle-Range and Large Capacities.
- Selection of Automatic Operating and Safety Controls.
- Instant Change from Fuel to Fuel.

Send for bulletins describing Model 3 and Model 4 *Powermaster* units.

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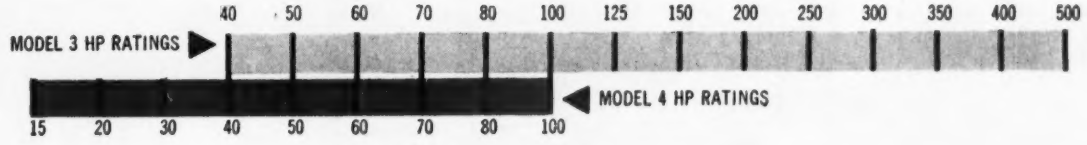
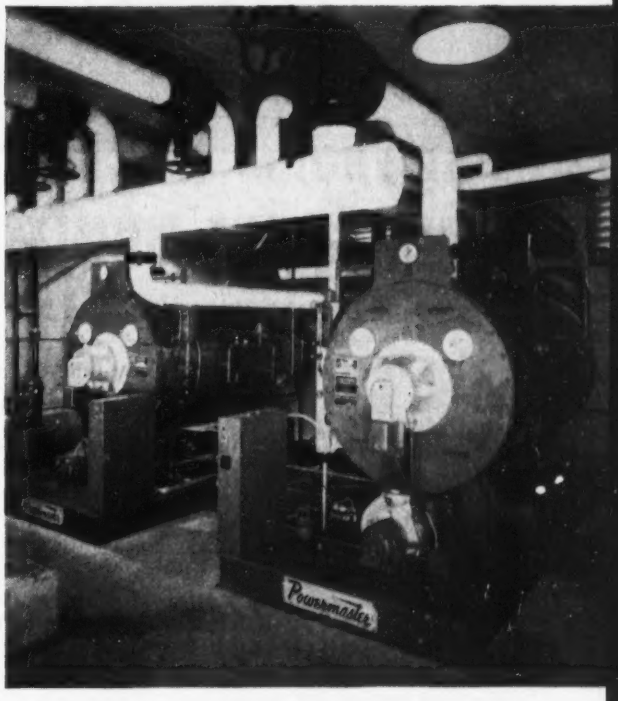
Powermaster Packaged Automatic Boilers to meet your specific operating requirements . . . to your best advantage.

for 15 to 250 psi. steam or hot water



Model 4 *Powermaster*—Service-proved in wide variety of successful applications. These 40 HP units supply 15 psi. steam for heating. Simplicity of operation and controls is an important advantage.



- Choice of Fuels:
  Light Distillate—Natural Gas—Manufactured Gas—Combination Oil and Gas.
- Choice of:
  Mechanical Pressure Atomizing Oil Burner—Pre-Mix Gas Burner—Combination Oil and Gas Burner—All Designed and Built by O & S.
- Simple On-Off and Low-Fire Start Burners.
- Small and Popular Middle-Range Capacities.
- Selection of Automatic Operating and Safety Controls.
- Quick Change from Fuel to Fuel.

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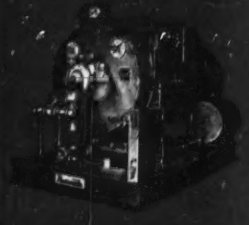
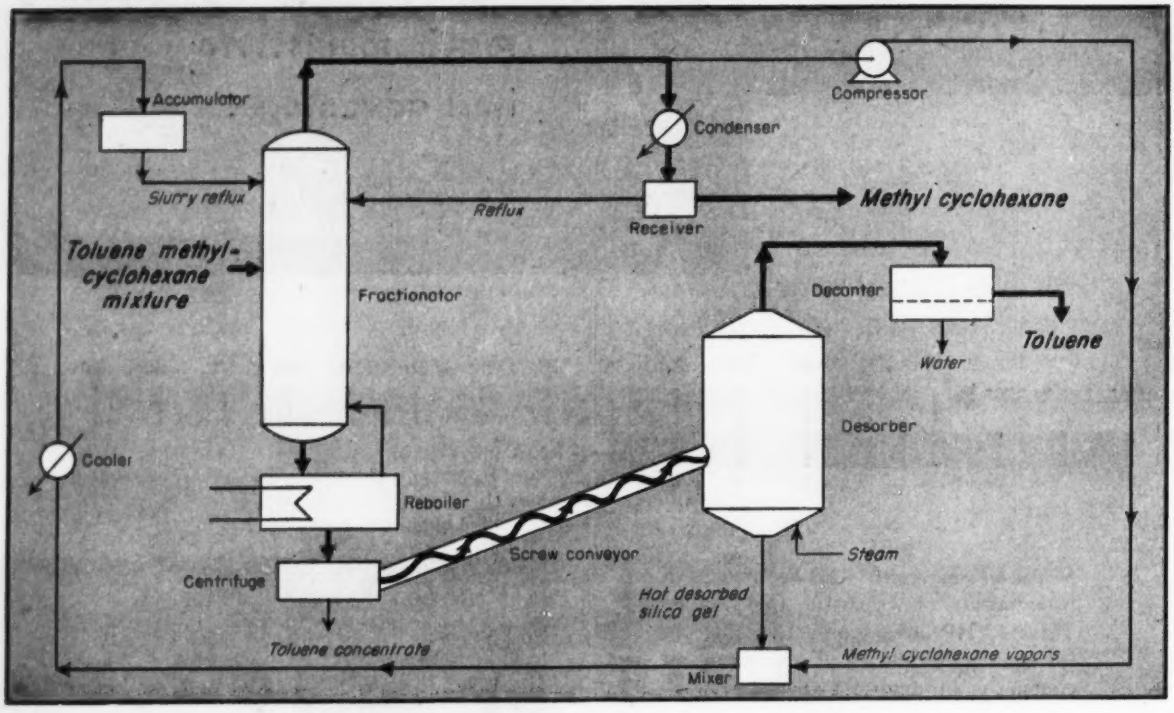
PACKAGED AUTOMATIC BOILERS





How to Separate Close-Boiling Hydrocarbons

Fractionating in the presence of a slurry of solid adsorbent in liquid hydrocarbon can make separation easy. Method involves combination of two unit operations.

Combine two unit operations—adsorption and distillation—into one. That's the trick in separating hydrocarbons with similar boiling points. The way to do it is to fractionate in the presence of a solid adsorbent-liquid hydrocarbon slurry.

The new method has proved successful in separating (1) toluene from lower boiling virgin naphtha fractions, (2) olefins from narrow boiling naphtha fractions and (3) paraffinic hydrocarbons from their more highly branched isomers.

▶ **Recommended Adsorbents**—Suitable adsorbents — used individually or in combination—are silica gel, activated carbon, activated coconut charcoal, bauxite and activated alumina.

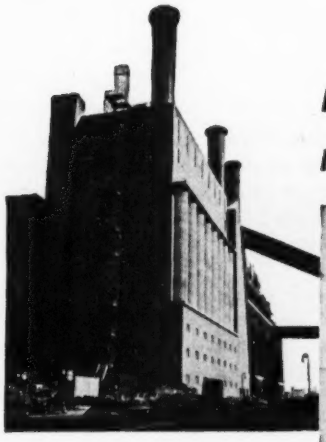
Activated coconut charcoal, because of its selective adsorption of normal paraffins over branch-chained hydrocarbons, is preferred for separating mixtures of these compounds.

▶ **Optimum Conditions**—For best results, it is necessary to adjust:

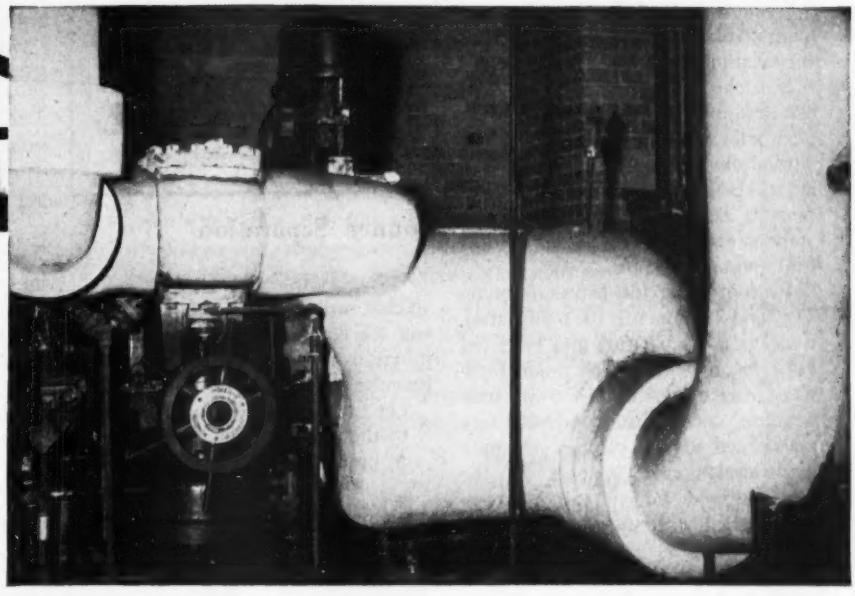
- Temperature of the slurry entering the tower so that it approximates the column temperature on the slurry feed plate. The temperature can, however, be lowered to condense part of the vapors rising to this point.
- Concentration of hydrocarbons in the feed to the hydrocarbon concentration in the column. Feed is introduced at a point in the tower where these concentrations are equal.
- Temperature of the hydrocarbon feed to equal that of the refluxing liquids at the feed point.
- Ratio of solid adsorbent to feed above a critical minimum of 100 to 200 wt. percent.

▶ **Typical Run**—A feed mixture of toluene and methylcyclohexane is fractionated in the presence of a silica gel adsorbent. The silica gel is added at a rate equal to 100 to 800 wt. percent of the hydrocarbon feed. Concentration of slurry solids is usually kept below 50 wt. percent to give a fluid, flowable slurry.

As feed vapors rise in the column, some of them are adsorbed on the large excess of descending silica gel. Tower conditions are such that liquid mixtures of toluene and methylcyclo-



For this addition to their New York City power plant at East River and 14th Street . . .



(Above) View of recently completed annex to Consolidated Edison's power plant . . . another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier . . . the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia . . . industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem . . . remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor . . . or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

*Reg. U.S. Pat. Off.

Skilled Applicators on the team of a J-M Insulation Contractor applying J-M 85% Magnesia to pipelines. Located throughout the nation, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as *quality* products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

Johns-Manville *FIRST IN* INSULATION

MATERIALS ENGINEERING • APPLICATION

hexane are at their boiling points and continuously in contact with vapors from below.

▶ **Products Separated**—Because of enhanced volatility of methylcyclohexane (in relation to toluene), vapors are rich in this component. If you hold the ratio of adsorbent to hydrocarbon feed rates to a value at which feed adsorption is complete, optimum relative volatilities for separation of components is obtained. Significant separations can, however, be obtained at lower adsorbent rates.

By controlling the hydrocarbon reflux (and consequently the reflux ratio), the degree of separation may be varied until you get the desired product purity and recovery. Suitable tower temperature and reflux conditions are maintained so that substantially pure methylcyclohexane appears in the overhead and toluene, adsorbed on and slurried with silica gel, is in the bottoms.

Overhead vapors of almost pure methylcyclohexane flow from the column top, through a condenser, to a receiver. Part of the condensate is returned to the column. The remainder is withdrawn as product.

Bottoms, consisting of a slurry in toluene concentrate, enter a reboiler where some of the hydrocarbons are vaporized and returned to the tower bottom. The rest go to a centrifuge to separate the toluene concentrate from the silica gel.

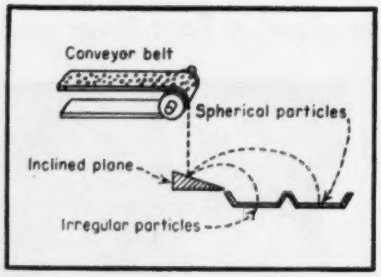
Separated silica gel is carried, by screw conveyor, from the centrifuge to a desorber. Here substantially dry gel is fluidized by steam. The steam also strips adsorbed toluene from the gel.

Toluene vapors flow from the desorber to a decanter where they are separated from condensed steam.

Hot silica gel passes from the desorber to a mixer. Part of the methylcyclohexane vapors, under pressure, enter the mixer to fluidize the gel particles and return them to the top of the tower.

Fluidized silica gel flows to a cooler where methylcyclohexane condenses. A slurry of the hydrocarbon and silica gel collects in the accumulator. From here it is introduced into the tower.

The inventor, Walter A. Herbst, has assigned his patent, U. S. 2,665,315, to Standard Oil Development Co.



Bounce Separation

"It's obvious."

That will be your reaction, when you see how simple it is to separate spherical gel particles from fines and irregular pieces.

Let them bounce. That's all there is to the clever new method.

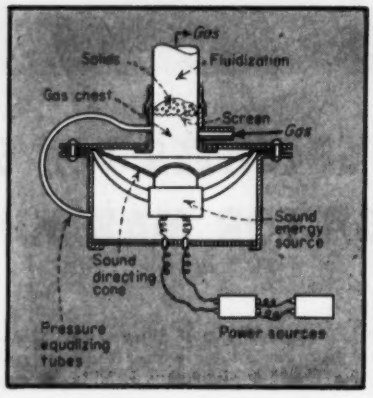
A bead mixture is dropped from a predetermined height onto an inclined plane. Whole beads, because of their round shape, bounce further than other particles. These collect in a chute farthest from the "jump-off" point.

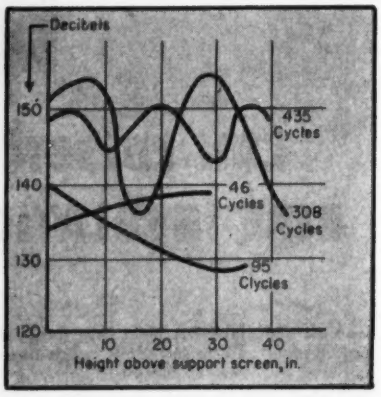
Aside from its simplicity, the new procedure has an edge over conventional screening separations:

- Bead breakage—caused by grinding effect of fines on whole beads—is eliminated.
- Screens—which can foul or plug up—aren't needed.

The inventor, John W. Payne, describes adaptations of the method to both continuous and successive separations.

Mr. Payne has assigned his patent, U. S. 2,666,524, to Socony-Vacuum Oil Co.





Sonic Energy Fluidizes Solids

A novel set-up using sonic vibrational energy can be the answer to the problem of fluidizing normally nonfluidizable solids.

In the new device, the bottom of the fluidization reactor is closed off by a screen. This permits the passage of fluidizing gas upward, but prevents the flow of solids down into the gas chest. Fluidizing gas enters an inlet tube below the screen.

The gas chest opens into a housing in which is mounted the sound energy source and sound directing cone. A tube is connected between the gas chest and the housing to equalize static pressures.

The variation of sound intensity at various levels above the support screen is graphically illustrated. Sonic vibrational energy in the range of 40 to 800 cycles per second with transmitted sound pressures above 100 decibels gives satisfactory results.

Data from laboratory tests with plaster of paris (averaging 15 microns in size), marble dust and with other materials in the size range of 2 to 30 microns are cited in the patent.

The patent, U. S. 2,667,706, has been assigned by the co-inventors, Rollin D. Morse and Edward F. von Wettberg, Jr., to E. I. du Pont de Nemours & Co.

FACTS ON INFRARED FOR THE PROCESS PLANT

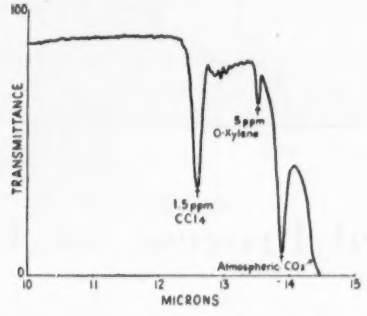
Air Pollution...You must measure it before you can eliminate it!

Before you can take effective measures to eliminate air pollution, you've got to determine its nature and extent. This is no simple task by standard chemical techniques. First, you can't be sure, with the old techniques, of 100 percent extraction of the contaminants from the air sample. Second, your collected sample is so small you can't further separate, and chemical analysis for one component may destroy another.

An infrared spectrometer with a long path gas cell can overcome both of these difficulties. With such equipment you can identify and measure contaminants with speed and accuracy. Usually, no extraction, separation, or concentration steps are involved.

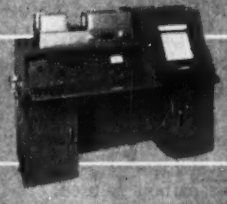
The infrared spectrum shown would result from a concentration of 1.5 ppm CCl_4 and 5 ppm ortho-xylene in room air compressed to 10 atmospheres in a 10-meter path length absorption cell. All components in sample appear simultaneously and their concentrations can be determined from the strength of their absorption bands.

If you have a problem in air pollution control, why not let Perkin-Elmer engineers show you how infrared analysis can help solve it?

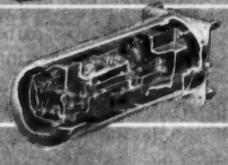


Spectrum showing trace amounts of CCl_4 and xylene demonstrates extreme sensitivity of infrared methods for analysis of atmospheric samples.

THE ONLY COMPLETE RANGE OF INFRARED INSTRUMENTS TO MEET ALL REQUIREMENTS



FOR THE PILOT PLANT—*Model 14 Multi-Component Analyzer*— Continuously records the concentration of up to six components in a pilot process stream on a six-minute cycle. Ideal for tracking the effects of temperature, pressure, etc., changes in a pilot stream.



FOR THE PROCESS PLANT—*Model 93 BICHROMATOR* Analyzer* —For continuous control of liquid or gas streams. Records the ratio of any two wavelengths chosen. Thermostatted; enclosed in explosion-proof containers.

FOR THE PROCESS PLANT—*Model 105 TRI-NON* Analyzer* —Highly stable and sensitive. Suitable where there is considerable interference from stream components. Thermostatted; enclosed in explosion-proof containers.

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Model 14 ..... Models 93 and 105 .....

NAME .....

TITLE .....

COMPANY .....

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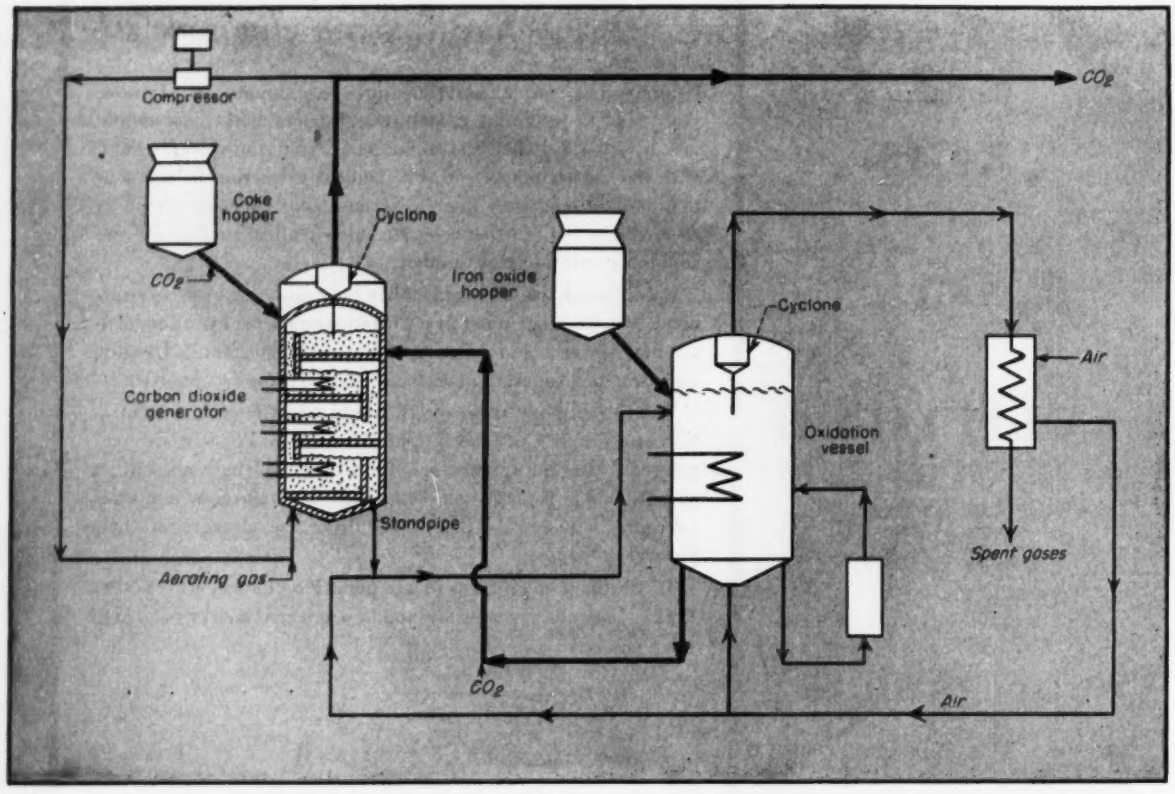

Improved Process for CO_2 Production

Here's a new technique for the economical production of carbon dioxide which is free of inert gases. The key: use of metal oxides as oxidizing agents.

You can produce carbon dioxide economically and efficiently if you use metal oxides instead of air for the oxidizing agents. That's the basis of a new process recently developed by Warren K. Lewis and Edwin R. Gilliland.

▶ **Oxide Requirements**—Oxides recommended for the new process must conform to four specifications. They must remain solid within the range of operating temperatures; they must not sinter at those temperatures; they should be capable of regeneration by air oxidation below sintering temperatures; they should possess high oxidation potentials.

Ferric oxide, either pure or in Fe_2O_3-rich ores, is suggested because of its availability and low cost.

Low-ash charcoal and coke are ideal carbon sources.

▶ **Fluidized Beds**—Both raw materials, the solid oxygen carrier and carbon source, are used in the fluidized state. This affords excellent contact between solids, ideal temperature control and greatest uniformity of distribution.

The result is an extremely flexible process, one in which the degree of oxidation can be easily controlled.

▶ **Preferred Procedure**—In the patent, three methods are described. Of these, one is preferred.

Finely divided coke feeds into the top of the carbon dioxide generator. Aerating gas, such as carbon dioxide produced in or introduced into the chamber, aids the flow of solids.

To assure high reaction rates and to carry oxidation as far as possible, a substantial excess of Fe_2O_3 over oxidizable carbon is used.

In starting the run, iron oxide can be mixed with carbon in the oxidation chamber. Burning the carbon serves to heat the mixture.

Fluidized hot iron oxide collects in the withdrawal well, then passes (under pseudo-hydrostatic pressure) into the generator top.

▶ **Generator Reaction** — Introducing hot combustion gases at the bottom—for fluidization and heat supply—starts up the generator. In operation, recycling gases from the top are used.

Fe_2O_3 overflows through weirs from

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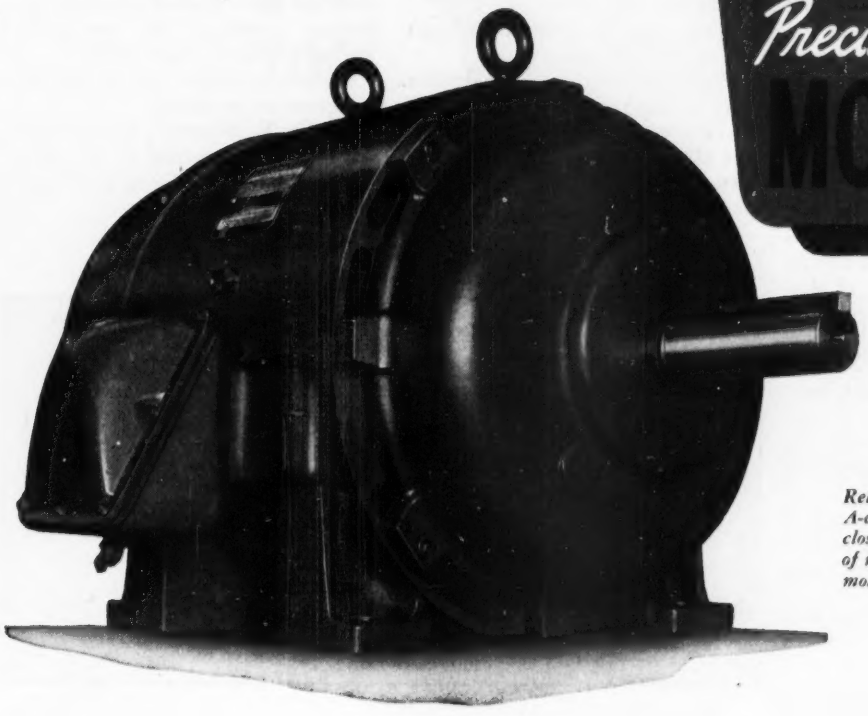

Reliance Totally-enclosed Fan-cooled A-c. Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from 3/4 to 300 hp.

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- ☆ Tough, chemical-resistant Reli-X insulation
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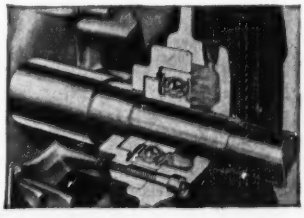

. . . AND THE BEST PRE-LUBRICATED BEARING DESIGN

The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease 'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1454

RELIANCE ELECTRIC AND ENGINEERING CO.

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the generator top to bottom while fluidizing gases move up through the trays. A 2-3 ft. level of solids is maintained on each tray. Superficial linear flow velocities of fluidized gases within the bed can vary between 0.3 and 4 ft. per sec.

▶ **Pure Product** – Substantially pure CO_2, removed from the top of the generator, passes through a cyclone to knock out solid particles.

Spent oxygen carrier is reoxidized with air in a separate reactor and returned to the carbon dioxide generator.

▶ **Improvement Over Old**–The new process overcomes certain drawbacks in the two common industrial sources of carbon dioxide–byproduct of alcohol fermentation and flue gas recovery.

Alcohol fermentation yields pure cheap CO_2, but quantities are limited.

Flue gas recovery, while satisfactory, requires cumbersome operations, consumes large quantities of heat. In addition, the use of air as an oxidizing agent (conventional practice) yields a product containing large amounts of inert gases such as nitrogen. This complicates the concentration of CO_2 by condensation or absorption.

The Lewis and Gilliland method provides:

- Cheap source of CO_2.
- Inert gas-free carbon dioxide, in unlimited quantities.

Complete operating details, as well as test results, are given in the patent, U. S. 2,665,971.

In a second patent, U. S. 2,665,972, the same inventors describe a modification of the process, using copper oxide with a carrier such as silica gel instead of Fe_2O_3.

Both patents have been assigned to Standard Oil Development Co.

Iron Oxide Pigments for Brighter Auto Finishes

The outlook for automotive finishes may be brighter with the appearance of novel red iron oxide pigments of high color intensity and purity. These pigments give promise of replacing organic colors (in the range of dark reds or maroons) and common red iron oxide pigments.

Color intensity of the new pigments matches that of organics previously used. Combine this feature with permanent resistance to sunlight and economical manufacture and you can see why organic colors may have competition.

▶ **Old Vs. New**–In contrast to known red iron oxide pigments, the new have several distinct advantages:

Shape–spherical rather than irregular, angular particles.

Size–closer tolerance in production.

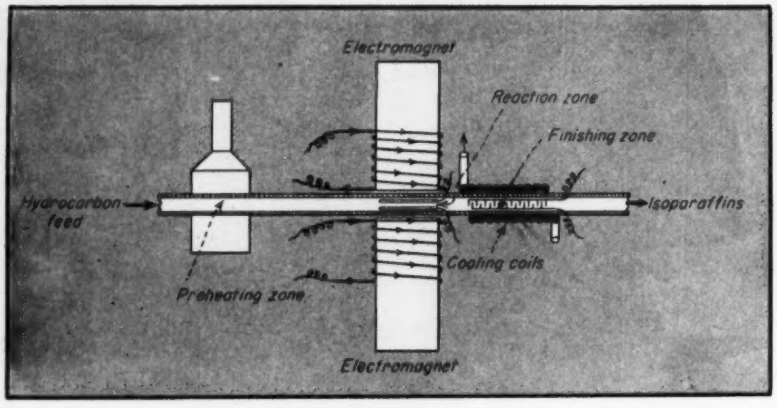
Wavelength–greater than 615 millimicrons, a dominant range never before obtained.

▶ **How They're Made**–The basic two-step reaction consists of (1) forming a precipitated hydrous ferric oxide slurry and (2) heating the slurry to promote conversion (or aging) of the hydrous oxide to the pigment.

Free ferric chloride in the slurry must be controlled. Accelerated aging of the hydrous oxide must be carried to a point beyond which further heating produces no perceptible change in the product's color.

Detailed examples of the process are given in the patent.

George E. Noponen, the inventor, has assigned his patent, U. S. 2,665,193, to Minnesota Mining and Manufacturing Co.



Electricity Sparks Hydrocarbon Switch

Here's a brand new method of changing the chemical structure of hydrocarbons. The key is combined use of magnetic and electrostatic fields.

Results: improved yields of iso from normal paraffins – never before obtained from the sole use of high frequency electric discharges or magnetic fields.

▶ **How It's Done**–Hydrocarbons, flowing through nonmagnetic lines, are heated to about 1,000 deg. F. in a preheating zone.

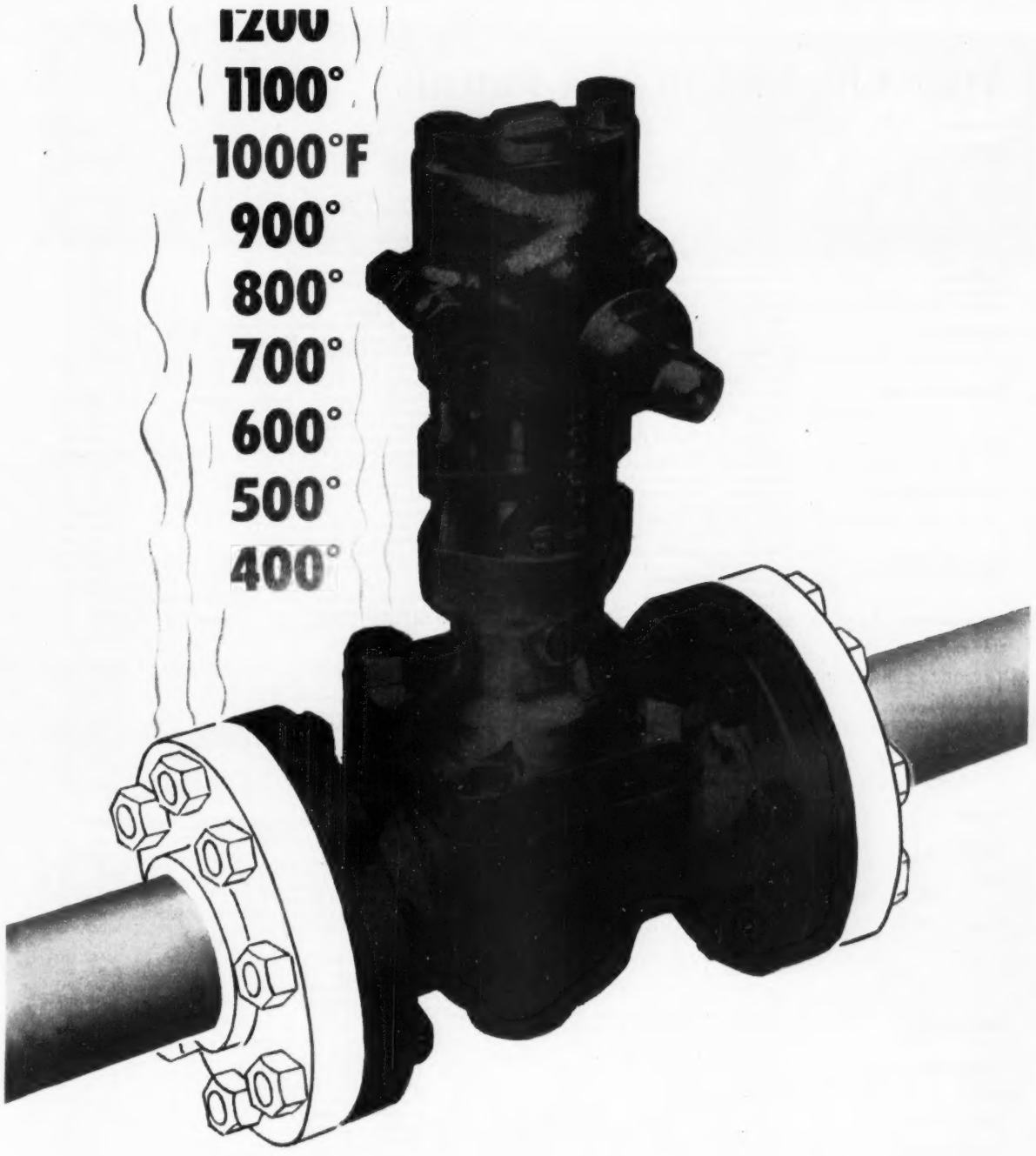
Next stop is a reaction zone equipped with high voltage electrodes (over 30,000 volts). A fairly low frequency electromagnetic field–in the range of 40 to 300 cycles per second–is produced here by electromagnets outside the chamber.

Effluent passes from the reaction zone to a combined deionizing and cooling zone. Deionizing potentials are supplied to a series of plates in this chamber. Deionization and cooling stop the reaction.

Experimental data given in the patent show a conversion of propane, mostly to isobutane and heavier isoparaffins.

The patent, U. S. 2,664,394, has been assigned by William B. Reeves, the inventor, to Phillips Petroleum Co.

This department is designed to keep you up-to-date on chemical equipment and processes. To get any patents, including those mentioned here, order from the Commissioner of Patents, Washington 25, D. C. Each patent costs 25 cents.



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Lift-Plug Valves are ideal for high temperature service. They require no lubrication to effect a seal. They require no lubrication for easy operation. Their advanced design employs a seat which is separate from and not attached to the body, is not affected by body distortions resulting from elevated temperatures or line pressures.

The standard Cameron High-Temperature Valve is recommended for temperatures ranging up to 1000° F. Using special materials, these valves are performing satisfactorily at 1600° F.

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Your Checklist of New Patents . . .

Operation . . .	About . . .	Inventor or Assignee . . .	Patent No. .
Adsorption	Continuous adsorptive separation	Standard Oil Development Co.	2,666,500
Chemical reaction	Polymerization control apparatus	Ernest E. Rowland	2,665,197
	Studying chemical reactions by measuring interfacial film thickness	Hans J. Trurnit	2,666,355
	Calciner	Thomas R. Ellerbeck	2,667,342
	Apparatus for reforming hydrocarbons	Phillips Petroleum Co.	2,667,410
Crushing and grinding	Double impeller impact breaker	N. H. Kessler and H. I. Hansen	2,665,074
	Screen bar for crusher	Pennsylvania Crusher Co.	2,666,589
	Gyratory crusher	Allis-Chalmers Mfg. Co.	2,667,309
Distillation	Fractionating column with removable trays	Shell Development Co.	2,666,737
Drying	Drying solids in a fluidized bed	U. S. A.	2,666,269
	Rotary dryer	Gustav Bojner	2,666,633
	High-frequency electronic dryer	E. I. du Pont de Nemours & Co.	2,668,226
Extraction	Countercurrent extraction centrifuge	P. Steinacher and A. Boyng	2,665,061
	Multistage internal mixer-settler extractor	The Dow Chemical Co.	2,665,196
	Extractor for solvent recovery	Blaw-Knox Co.	2,665,198
	Liquid-liquid contactor	Standard Oil Development Co.	2,667,407
Extrusion and molding	Injection molder	Russell J. Sherman	2,666,230
	Apparatus for extrusion manufacture of tubular articles	Bitumex Ltd.	2,666,947
	Molder	Edward M. Stankewich	2,666,949
	Apparatus for drawing plastic sheets	U. S. Rubber Co.	2,666,951
Filtration	Percolation filter	Socony-Vacuum Oil Co., Inc.	2,665,811
	Mineral filter aid with high flow rate	Great Lakes Carbon Corp.	2,665,813
	Reduced capillary action in filtration	Peterson Filters and Engineering Co.	2,666,527
Fluid and particle flow	Apparatus for contacting gas with fluidized solids	Standard Oil Development Co.	2,664,966
	Pneumatic elevation of contact material	Sun Oil Co.	2,665,172
	Handling finely divided solids	Standard Oil Development Co.	2,667,280
	Handling finely divided solids	Standard Oil Development Co.	2,667,448
	High vacuum diffusion pump	Consolidated Vacuum Corp.	2,668,005
Gas-liquid contacting	Grid scrubber	C. D. Patents Ltd.	2,665,123
Heat transfer	Tubular heat exchanger	Andre Huet	2,665,889
	Making heat exchangers	Houdaille-Hershey Corp.	2,666,981
	Finned heat transfer element	Everett Chapman	2,667,337
Instrumentation	Liquid-solids interface indicator	The Davison Chemical Corp.	2,664,747
	Calibrated liquid storage gage	Sun Oil Co.	2,664,748
Mixing	Hydraulic power means and seal for pressure vessel agitators	Ernest E. Rowland	2,665,122
	Dry powder mixer	Arthur L. Hall	2,665,890
	Centrifugal mixer for liquids	Westfalia Separator A. G.	2,667,338
Solid-gas separation	Fibrous filter sheet for gases	Arne J. A. Asplund	2,664,964
	Dust arrester	Raymond H. Moore	2,664,966
	Electrostatic precipitator	Westinghouse Electric Corp.	2,665,770
	Vortex concentrator	Ferros Metals Research Co. Ltd.	2,665,809
	Electrode assembly for electrical precipitators	Western Precipitation Corp.	2,666,495
	System for energizing electrical precipitators	Research Corp.	2,666,496

Product . . .	Process . . .	Inventor or Assignee . . .	Patent No. . .
Carbon	Production of activated carbon	Allied Chemical & Dye Corp.	2,667,460
Fats and oils	Refining fatty oils	The Sharples Corp.	2,666,074
	Decolorizing safflower oil	L. M. Christensen and R. J. Norton	2,667,499
Fuels	Gasification of carbonaceous solids	Hydrocarbon Research, Inc.	2,665,200
	Manufacture of carbureted water gas	Humphreys and Glasgow Ltd.	2,665,201
	Reforming gaseous hydrocarbons for city gas production	The United Gas Improvement Co.	2,665,979
Gases	Low temperature air separation	Union Carbide and Carbon Corp.	2,664,718–9
	Purification of chlorine-containing waste gases by treatment with alkaline nitrite solution	Allied Chemical & Dye Corp.	2,665,190
	Generation of CO	The Texas Co.	2,665,980
	Separation of air	The British Oxygen Co. Ltd.	2,666,303
	Oxygen from air	Joy Manufacturing Co.	2,667,043–4
	Selective absorption of acetylene from gaseous mixtures	Koppers Co., Inc.	2,667,234
Hydrocarbons	Refining catalyst-laden hydrocarbons	The M. W. Kellogg Co.	2,665,239
	Alkylation of aromatics	Standard Oil Development Co.	2,667,519
	Fractionation of natural gas	Hudson Engineering Corp.	2,668,139
Inorganic chemicals	Production of cuprous oxide	The Mountain Copper Co., Ltd.	2,665,192
	Conversion of HCl to chlorine	Allied Chemical & Dye Corp.	2,665,195
	How to get anhydrous HCl	Diamond Alkali Co.	2,665,240
	Production of finely ground, non-caking sulfur	Mathieson Chemical Corp.	2,665,973
Metals and ores	Anodic aluminum coating	Siegfried Junghans	2,666,023
	Zinc production	The National Smelting Co. Ltd.	2,668,047
Organic chemicals	Isomerization of dichlorobenzenes	Union Carbide & Carbon Corp.	2,666,077
	Production of carbon disulfide	Food Machinery & Chemical Corp.	2,666,690
	Purification of isopropyl alcohol	Standard Oil Development Co.	2,666,735
	Azeotropic distillation of n-propyl-sec. butyl alcohol mixtures	Celanese Corp. of America	2,666,736
	Synthesis of terephthalic acid	U. S. Rubber Co.	2,666,780
	Refining tar acid oil	Pittsburgh Consolidation Coal Co.	2,666,796
	Olefin isomerization	Phillips Petroleum Co.	2,666,798
	Aldehydes separated from aliphatic hydrocarbons by azeotropic distillation with perfluoro cpds.	Phillips Petroleum Co.	2,667,450
	Formaldehyde manufacture	Union Oil Co. of Calif.	2,667,513
Plastics	Producing transparent polystyrene sheets	Cast Optics Corp.	2,665,452
Resins	Production of synthetic resins with improved light stability	Imperial Chemical Industries Ltd.	2,665,265
	Preparation of copolymers of styrene and divinylbenzene	Petrocarbon Ltd.	2,665,270
	Metal coatings containing phenol-formaldehyde resin and phosphate	Cosmocord Plastics Ltd.	2,668,158
	Stabilization of sulfone resins	Ansul Chemical Co.	2,668,160
Rubber	Compounding butyl rubber	U. S. Rubber Co.	2,665,264
	Vulcanization of rubber	Monsanto Chemical Co.	2,665,268
Synthesis gas and products	Production of synthesis gas	Standard Oil Development Co.	2,665,199
	Starting-up procedure for hydrogenation of CO	The M. W. Kellogg Co.	2,666,077
	Purification of synthetic water-soluble carboxylic acids	Stanolind Oil and Gas Co.	2,667,502
	Decobalting oxo aldehydes with ion exchange resins	Standard Oil Development Co.	2,667,514

ENGINEERING News

TRADE PAPER EDITION
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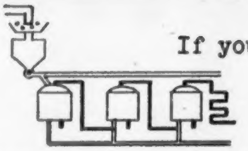
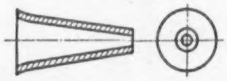
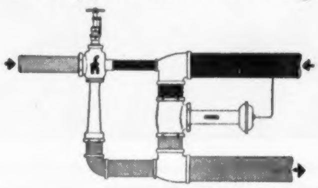
JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • ... SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS ...


If you plan, supervise, or maintain continuous process operations, consider the suitability of SK Jet Apparatus for such operations. For jet apparatus, though it requires skill in designing, is outstandingly simple — has three principal parts which include: a converging nozzle for liquid actuated jets  or an expanding nozzle for gas actuated jets , a tail or diffuser , and a body to hold these parts in their proper relative positions.

Jet apparatus fits right into the pipeline. The actuating medium can be either


liquid or gas. Small, in relation to the work they do, easy to install and maintain, one of many SK Jet Types can be used to:

1 MEASURE and MIX
In Continuous Operation

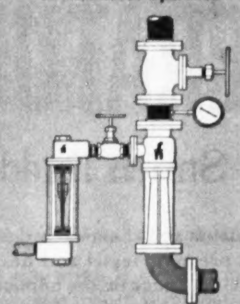
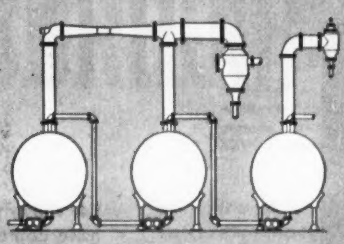


FIG. 242-B. SK Jet Eductor and SK Rotameter are used to mix liquids in desired proportion.

2 COOL and CONCENTRATE
In Continuous Application



SK High Vac apparatus used to cool sugar syrups after processing.

3 PUMP and HEAT
In Continuous Process

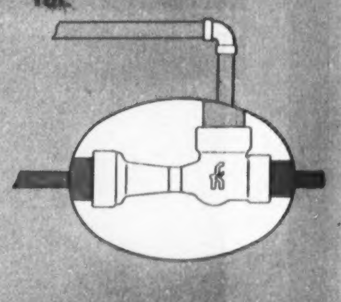


FIG. 217. SK Steam Jet Syphon mixes cold water with steam to discharge hot water.

and (4) to perform thousands of similar jobs in plants all over the country. For types of Jet Apparatus offered by SK and a summary of applications, write for Bulletin SK-1.

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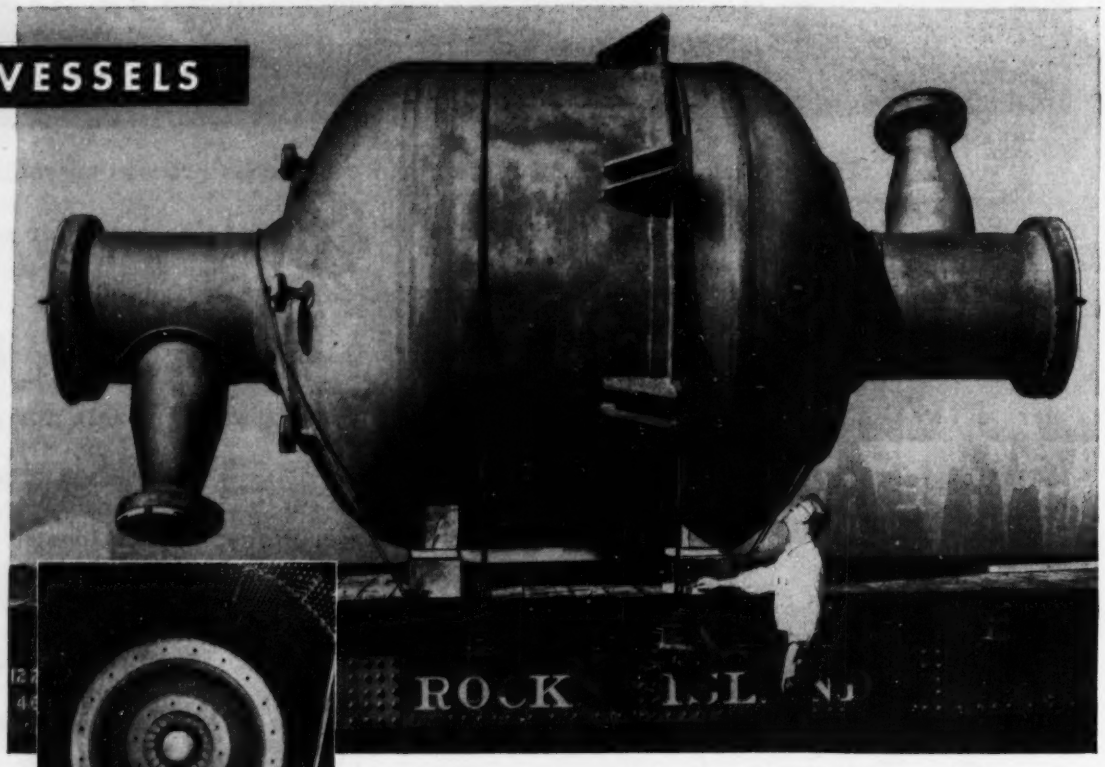
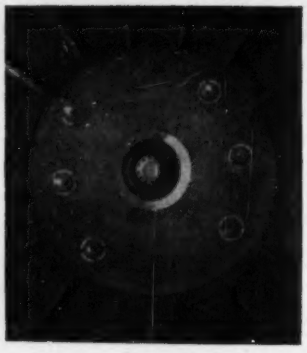


Refractory-lined reactor ready for shipment from the Milwaukee plant. Overall length, flange-face to flange-face: 21 ft. 7 in. Three of these A. O. Smith reactors, when installed, become the heart of a catalytic reforming plant.



These interior views show, *at top:* expanded metal liner support prior to gunniting insulation. Grid platform support rings are visible. *Lower picture* shows shop-installed refractory lining covered by stainless steel lining designed with interlocking expansion joints.

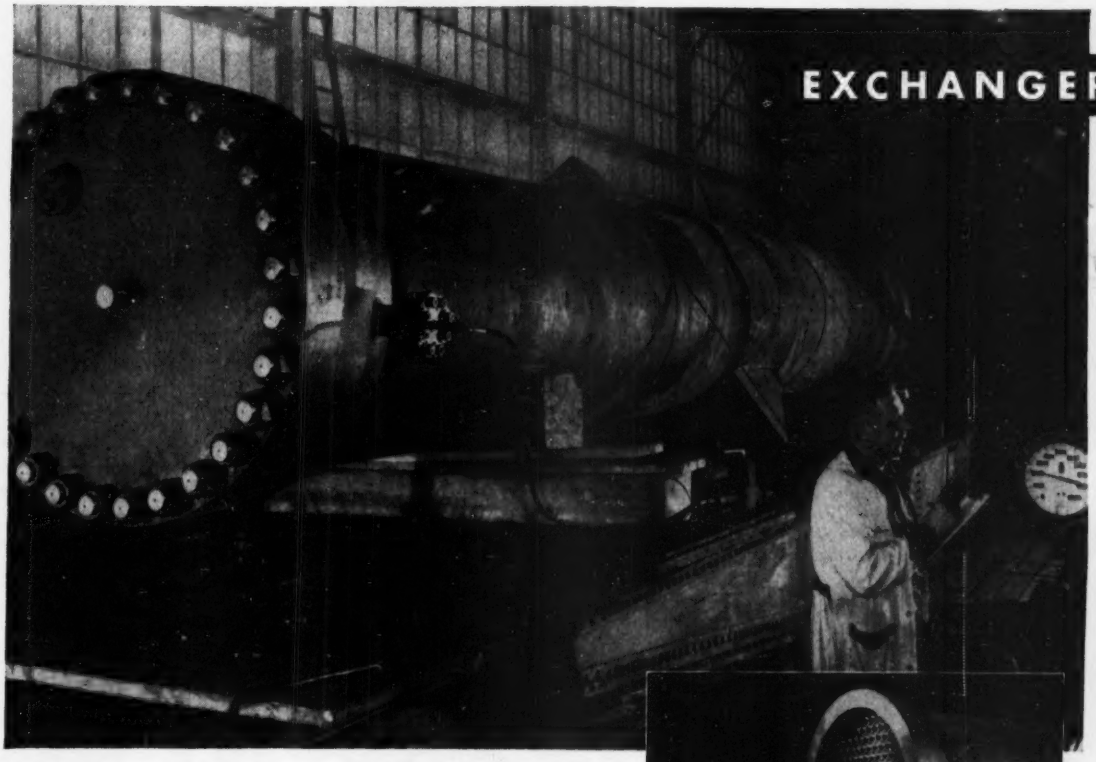
HIGH TEMPERATURE

A. O. Smith lined and

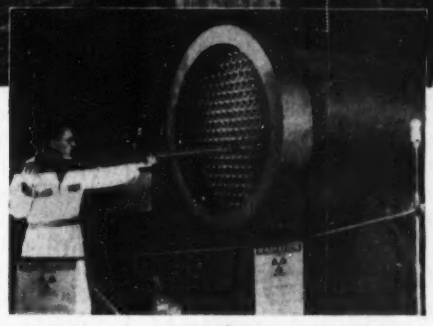
For thirty years, petroleum and chemical industries have come to us with pressure vessel and heat exchanger problems. Their reliance on the unmatched advantages we offer in manufacturing know-how and the resourcefulness of our research laboratories and technicians, design engineers and shop men has proved to be well placed. The two reactors shown here are examples of our work.

On this page is a special, refractory-lined vessel of A-212 steel, designed for 650 psi. and temperatures starting at 900° F. The walls are protected by shop-installed refractory lining. Total weight of 50 tons includes 28,000 lb. of lining, its supports

Outstanding Advantages



Shown here is one of twenty poly reactors going through our heat exchanger shop, undergoing tube side pressure test at 2160 psi. One-quarter inch wall tubes are welded to tube sheets and tubes rolled full depth on all poly reactors.



Radioactive cobalt being used for examination of welds during poly reactor construction. This method permits examining welds that are inaccessible to X-ray equipment.

HIGH PRESSURE
tubular reactors

and a catalyst grid platform on pedestal rings.

On this page is shown a poly reactor undergoing shop tests before shipment. Throughout fabrication and long before shop work begins, materials and processes are subjected to exhaustive tests to make sure quality demands are met. Metallurgical, spectrographic and pressure tests during and at completion of construction assure conformity to specifications.

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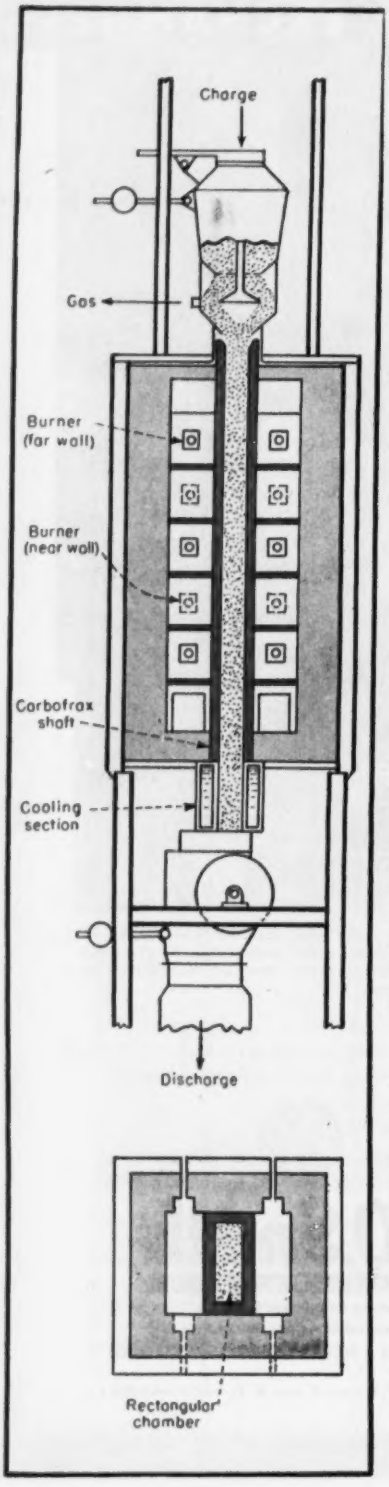
NEW PROCESSING EQUIPMENT



Continuous Retort Holds Shape

Even with high temperature differentials this continuous vertical retort holds its shape, doesn't develop leaks. Refractory life is longer, upkeep less.

At high temperatures there's always the problem of contraction and expansion, splitting and cracking of refractories. Differential temperatures cause the trouble.

Design of the new Petrocarb high-temperature retort aims at overcoming such difficulty. Even-distribution of heat to the chamber has been sought. Close control of heat depends upon use of multiple burners spaced around the calcining shaft.

And the refractory lining is kept prestressed to counteract forces that open cracks producing leaks. Compression springs act on one wall of the chamber to produce prestressing.

These design features of the Petrocarb unit highlight the high thermal-capacity. For they contribute to long operating life despite large heat flow through the retort.

▶ **Tall and Thin**—First unit built is being operated as a pilot retort at the Cabot Carbon Co., Pampa, Tex. Basically, it's a vertical shaft 12 ft. high with a 3 x 1 ft. cross section. Feed and discharge hoppers at top and bottom are equipped with double seals to exclude air.

Shaft is lined with Carbofrax silicon carbide refractory brick. Thermal conductivity of this material is in the same range as high temperature alloy steels. It is possible to reach temperatures well above 2,000 deg. F. inside the retort at heat transfer rates up to 10,000 Btu. per hr. per sq. ft. of shaft area.

▶ **Flue Jackets**—Flues on either side of the Carbofrax shaft circulate heat from the multiple gas burners. Temperature on the retort wall can be held at almost any level up to 2,600 deg. F. This a practical maximum for commercial operation without increasing the cost for refractories.

Rate of throughput is controlled by a continuously moving discharge mechanism at the bottom of the retort. Before entering this zone the down-flowing solids pass through a water-cooled support section where they are cooled below the ignition point.

▶ **What Cooks**—Highly successful tests are reported using this retort for calcining non-coking coal to produce char, as a source of elemental carbon. Interesting results of the first commercial operation of this type are expected to be announced soon.

A similarly successful operation is possible when calcining petroleum coke. At one time considered the "garbage" of petroleum refining operations, coke now is raw material for aluminum pot-line electrodes. But it must be calcined to remove moisture and volatiles before it's suitable for this purpose.

Normally on large scale operations, producing several hundred tons per day, petroleum coke is calcined in rotary kilns. For smaller operations the rotary kiln is not efficient; there is too much shrinkage loss from combustion of coke. And it is on these smaller jobs that the Petrocarb retort is expected to provide economic calcining.

Before entering the retort the coke is preheated and pretreated to avoid agglomeration during calcining. Flue gas from the retort heaters does the preheating.

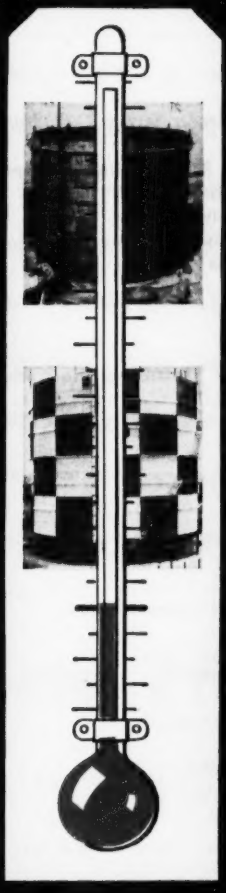
Offgas from the calciner is fed to the burners. Heat value recovered in this

Latest process equipment cost Index:

183.5

. . . See p. 352 for industry breakdowns.

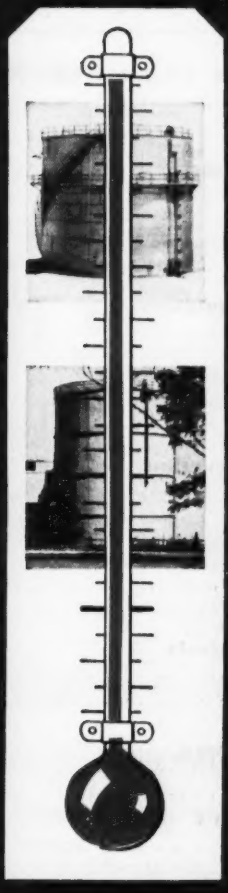
from the **ARCTIC** to the **TROPICS**



more than

130

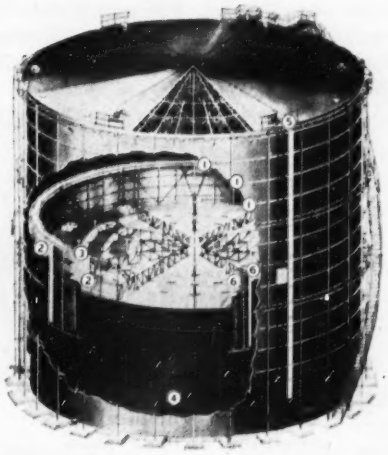
WIGGINS GASHOLDERS have eliminated operating costs for users of chemical process and industrial gases



This 100% dry seal gasholder (no water, no tar, no grease) has proved itself under every condition of climate and temperature. Because of the seal and the simple operating mechanism, operating costs have been entirely eliminated. Comparison of maintenance expense by owners of Wiggins gasholders also shows remarkable savings. Companies who have converted old-type gasholders to the Wiggins advantages have been able to enjoy similar savings. Write for information.

PISTON RISES NEARLY TO TOP—MINIMUM OF WASTE SPACE
CAN BE BUILT ANY SIZE • NO CONTAMINATION OF GAS

1. Space above piston completely ventilated
2. Wide clearances simplify operation.
3. Gas-tight frictionless seal not affected by weather.
4. Piston rests on bottom when empty—less than ½ of 1% dead space for purging.
5. Leveling device—independent of side wall—keeps piston level.
6. Fenders prevent all tension in seal.



Wiggins Gasholders

by GENERAL AMERICAN

WIGGINS VAPOR SEALS
GENERAL AMERICAN
TRADE MARK

General American Transportation Corporation
135 SOUTH LA SALLE STREET • CHICAGO 90, ILLINOIS

Offices in Principal Cities

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Equipment On These Pages This Month Made News . . .

Page Number is also Reader Service Code Number

New Processing Equipment
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- Filter Fabric 264A
- Vacuum Filter 264B

New Fluids Handling Equipment
- Valve 266A
- Dust Collector 266B
- Recycle Compressor 266C
- Plastic Pipe and Hose 266D

New Materials of Construction
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- Large Plastic Tubing 268B
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New Instruments & Controls
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New Packaging & Handling Equipment
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- Air Lock Feeder 278A
- Dual Trough Conveyor 278B
- Drum Up-Ender 278C
- Carbide Elevator 278D
- Iron Trap Warning System 278E

New Safety Equipment
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- Protective Cream Dispenser 280B
- Barrier Rope 280C
- Sulfur Dioxide Detector 280D
- Plastic Safety Windows 280E

. . . For more details, use Reader Service Card on page 499

fashion makes the operation essentially self-sustaining.

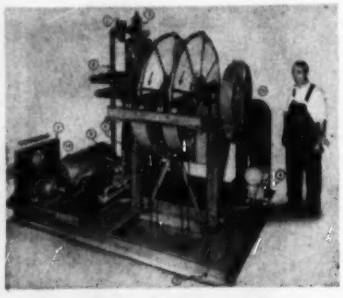
A number of other heat treatment processes are slated for investigation in the retort. Ability to control completely the calcining atmosphere will be used to good advantage.—**Petrocarb Equipment, Inc., 30 Vesey St., New York 7, N. Y.** 262A

Filter Fabric Woven of Polyethylene

Similar in characteristics to a fine wire cloth a new monofilament fabric is woven of polyethylene. It is recommended principally for free-filtering materials such as coarse crystals or fibrous pulps.

On such applications it has high filtering efficiency and does not blind or plug up in continuous operation. Its smooth filaments permit easy cleaning.

Fabric resists alkalis and inorganic acids. At room temperature it is resistant also to most organic chemicals. It is tough, abrasion-resistant and has excellent flexing properties at sub-zero temperatures.—**Filtration Fabrics Div., Filtration Engineers, Inc., 155 Oraton St., Newark 4, N. J.** 264A



Disk-Type Vacuum Filter Mounted on One Base

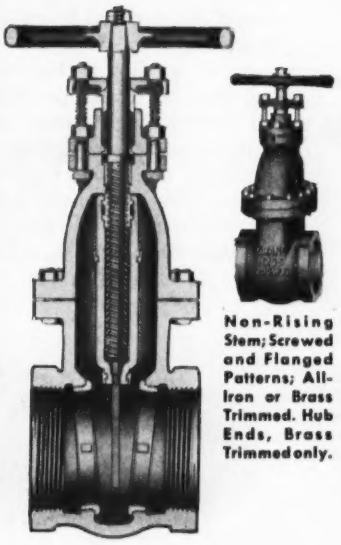
All dewatering elements for the Denver packaged disk-type vacuum filter have been located on one base. Both floor space and headroom are saved. Use of a wet vacuum pump eliminates need for moisture trap with extensive cumbersome overhead piping.

A two-disk filter measures 5 ft. 8 in. by 9 ft. 10 in. on the base, and is 7 ft. 10 in. high. As many as five disks may be used. Each additional disk increases length of the unit by 14 in.

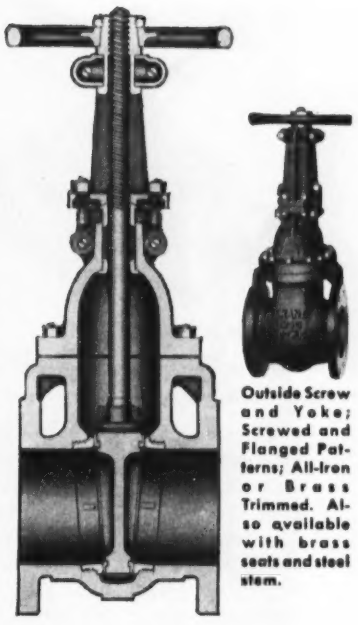
Filter is designed so that vacuum is held on start-up. A valve on the filtrate line maintains suction only on the submerged portion of the disk. After uniform cake has been collected on all segments normal vacuum distribution is resumed with a simple valve adjustment.

High filter mounting permits room for conveyor to take away cake. Partitions can be placed in the filter tank so that more than one product can be filtered.—**Denver Equipment Co., 1400-17th St., Denver 17, Colo.** 264B

Crane 125-Pound Iron Body Wedge Gate Valves are an improved design, embodying many features of unusual merit. They set a new peak for quality in iron body wedge gate valves, having greater strength, longer life, and better all-round adaptability for all types of services.



Non-Rising Stem; Screwed and Flanged Patterns; All-Iron or Brass Trimmed. Hub Ends, Brass Trimmed only.



Outside Screw and Yoke; Screwed and Flanged Patterns; All-Iron or Brass Trimmed. Also available with brass seats and steel stem.

See If You Don't Agree!

Here's the big value—the big selection: CRANE 125-Pound Iron Body Wedge Gates

. . . with quality features that assure exactly the kind of service you want. Body and bonnet are oval-shaped with extra metal where it's needed most, to provide liberal strength. Flanged patterns have tie-ribs between body and bonnet flanges. You also get a solid web-type disc with long guides . . . a stem of liberal diameter with long thread engagement . . . an exceptionally deep stuffing box with high-grade packing . . . a two-piece ball-type gland and flange—plus an easy-to-grip handwheel with oval-shaped rim. Non-rising stem valves have a brass bushed stem collar. OS&Y design includes a brass bonnet bushing, swinging eye bolts . . . and a tee-head disc-stem connection on sizes 12-inch and smaller.

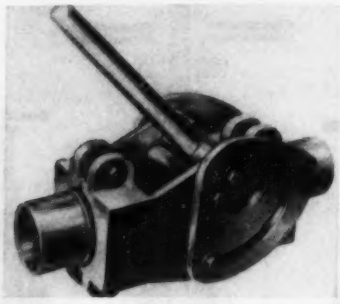
Big selection includes all-iron or brass trimmed valves . . . Underwriters' pattern valves, quick-opening types . . . valves for process industries . . . valves for marine service. Sizes up to 48-inch. Check your Crane Catalog or ask your Crane Representative next time he calls.

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



Valve

For on-off service operates by pinching off hose.

A quick-opening pinch type rubber valve operates manually for handling corrosive chemicals and slurries with grain sizes up to ⅛ in. The Type K valve has a snap action at the closing point. Bubble-tight closure and self-supporting feature make for positive shutoff and ease of installation.

Only rubber is in contact with the fluid; there is a choice of natural rubber or various synthetics. Temperature limit is 180 deg. F., with a pressure limit of 100 psig. Mechanical parts are aluminum with nylon bearings. Valve is available in sizes from ¾ through 12 in.—**Robert K. Little, 1623 Elaine St., Philadelphia 19, Pa.** 266A

Dust Collector

Offers new features for tube type unit.

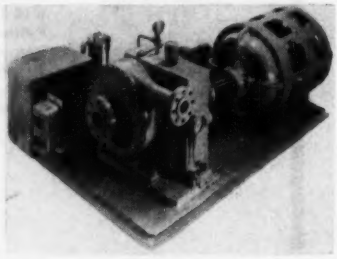
Designed to collect extremely fine dry dust particles, the Amerjet reverse-jet type fabric dust collector offers some new design features.

Operating principle is similar to other collectors of this type. Dust-laden air passes into individual tubes with air flowing through the fabric media while dust is retained on the internal surface. A traveling jet assembly dislodges the trapped dust with a reverse jet of air so that the dust falls into a collection hopper.

In the Amerjet, individual floating tension weights are used to connect each cloth tube with the dust storage hopper. Uniform tension keeps tube diameter constant despite different temperature and humidity conditions.

Design of connection between aluminum jet assembly and chain drive eliminates need for reversing directions; the connecting arms move around the sprockets to achieve direction change.

Air is supplied to the reverse jet ring through retractable rubber tubing. Venturi inlets to fabric tubes prevent abrasion from impingment of dust-laden air. Quick-fastening tube clamps allow easy, rapid installation and replacement of filter tubes.—**American Air Filter Co., Louisville 8, Ky.** 266B



Recycle Compressor

Gains maximum flexibility through interchangeability of standardized components.

Standardized designs for impellers, housings, diffusers, bearings, gears and shafts are featured in a new line of low-flow, high-pressure centrifugal compressors. As a result of interchangeability of parts, these compressors are available at a low capital investment.

Compressors will meet all recycle requirements in a range from 25 to 250 hp., flows as low as 100 scfm., pressure as high as 600 psig. and temperatures up to 700 deg. F.

Choice of three impeller designs with different aerodynamic characteristics increases the flexibility of the basic machine.

A high-pressure impeller is designed for service in a wide range of operations from approximately 50 percent below to 20 percent above design flow. Where flow requirements are variable and complete overload protection is required, a non-overloading impeller can be furnished. For completely stable operation from designed capacity down to zero flow, a non-surging impeller is recommended.—**Sawyer-Bailey Corp., 1559 Niagara St., Buffalo, N. Y.** 266C

Hose and Pipe

Possess outstanding resistance of Teflon and satisfactory mechanical properties obtained by modifying the basic resin.

Outstanding chemical inertness possessed by Teflon has been retained in Fluoroflex-T used in the fabrication of flexible hose and rigid pipe.

Flexible hose consists of a seamless extruded tube of plastic material reinforced with a braided jacket of stainless steel wire. Hose withstands temperature extremes ranging from —110 deg. F. to 450 deg. F.

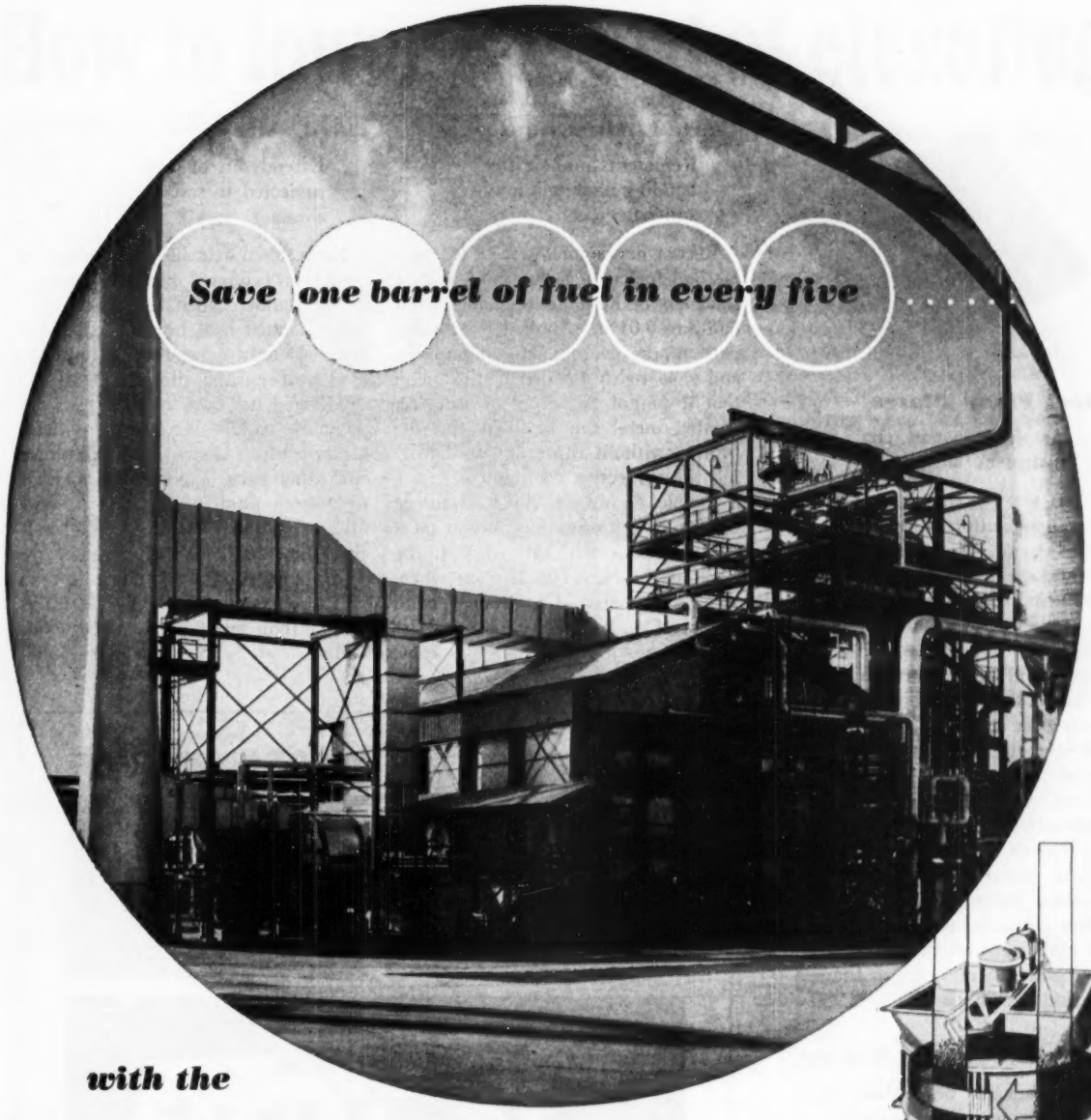
Laminated rigid pipe consists of an internal sleeve of Fluoroflex-T, to which is bonded an external jacket of Teflon-coated glass fabric. Where desired, an additional external sleeve of Fluoroflex-T can be applied.

Resultant pipe can be cut readily and fitted on the job with the aid of a portable heated flaring tool.

Accessory fittings for both hose and pipe permit installation of complete system. Hose presently is available in seven sizes from ¾ in. through 1 in. Sizes of 1¼ and 1½ in. will be available in the second half of 1954. Laminated pipe is offered in sizes of 1, 1¼, 2, 3 and 4-in. diameters.—**Resistoflex Corp., Belleville, N. J.** 266D

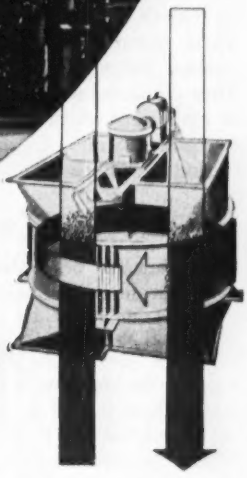
For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.



with the

Ljungstrom Air Preheater



The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

In every processing vessel that burns fuel, air preheat shows the way to save as much as *one barrel out of every five.* When refineries alone burn over 200,000,000 barrels every year, this means the *Ljungstrom Air Preheater* can recover tens of millions of *production dollars* that are now going up the stack.

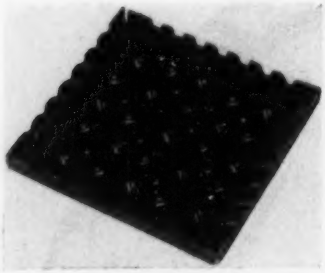
The Ljungstrom removes precious BTU's from exit gases and transfers them to combustion air. Its effectiveness can be gauged from the fact that every 35-40°F of preheat means roughly a 1% saving in fuel—and Ljungstroms now in use preheat air to over 600°F.

In addition to saving as much as 20% of your fuel, more effective fuel utilization means that your equipment can deliver greater throughput . . . can burn lower grade fuels with less slagging . . . lets you eliminate convection surfaces without reducing production.

In these days of high fuel costs, every process industry should consider the Ljungstrom for new installations or modernization of existing equipment. Call or write The Air Preheater Corporation for full details.

Wherever You Burn Fuel, You Need Ljungstrom

THE AIR PREHEATER CORPORATION 60 East 42nd Street, New York 17, N. Y.



Steel Floor Plates

Are held in concrete matrix by anchors.

You are looking at the under side of a new industrial steel floor plate called Ancor. Fingers extending from the surface and edges anchor the plate firmly in place when it is imbedded in concrete. Resultant steel-clad concrete floor stands up under the severest kind of industrial usage.

Ancor steel-clad floors are installed easily over sound wood floors, new or old concrete, or in place of worn brick, wood blocks, faulty metal plates or sheets. Concrete which fills in the perforations of the steel plate provides 31 smooth concrete islands per sq. ft. These islands provide a safe, quiet traction pattern in the flat surface. They eliminate need for corrugations or embossing which are noisy underfoot.–**Flash-Stone Co., Inc., 3723 Pulaski Ave., Philadelphia 40, Pa.** 268A

Large Diameter Tubing

Fabricated of unplasticized and unmodified polyvinyl chloride.

Vyflex rigid polyvinyl chloride tubing and ducting now is available with inside diameters of 6, 8, 10 and 14 in. Furnished in 4 ft. straight lengths Vyflex is manufactured from completely unplasticized and unmodified polyvinyl chloride.

Several efficient joining methods may be employed to produce multiple-pipe-length installations. Material is ideal where large diameter sections are needed for corrosive conditions such as found in waste systems, exhaust ducts and feeder lines. Chemical composition is identical with Vyflex rigid polyvinyl chloride pipes and sheets.–**Kaykor Industries, Inc., Yardville, N. J.** 268B

Coated Aluminum

Represents pinhole free bonding of fluorocarbons and base metal.

Recent developments have led to a method for coating aluminum with a thickness of Kel-F in the range from 0.005 to 0.01 in. Applied from a dispersion, the coating has no pinholes and is so tightly bonded to the metal that it cannot be peeled or stripped. Coated metal can be bent and deformed without rupturing or damaging the protective coating.

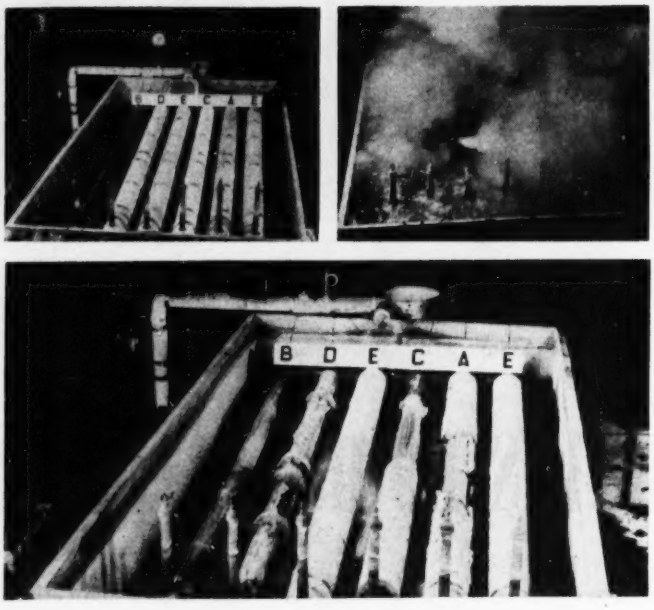
People desiring to take advantage of this new process may do so on a contract basis with all work to be done at the New Haven plant where it was originated.–**Connecticut Hard Rubber Co., New Haven, Conn.** 268C

Hard Alloy

Extends life of parts subjected to severe abrasion.

Exceptional wear life under abrasive conditions is offered by a new chrome-ferrous alloy called ZeVeSeal W Series. Actual field tests indicate this material outwears other commonly used wear-resisting alloys by 3:1.

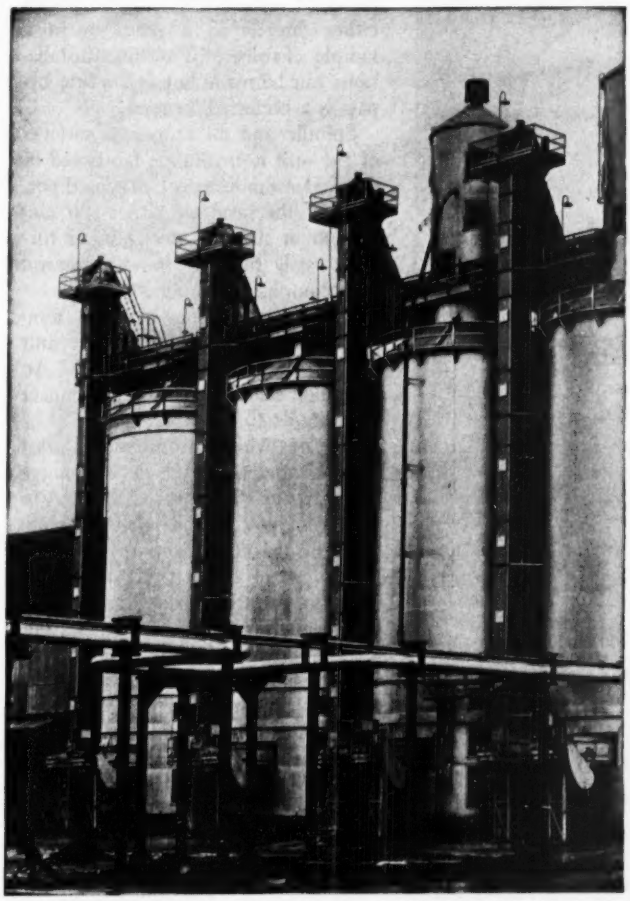
Material has been used in tests on pug-mill paddles, conveyor rollers, fertilizer mixer blades, sand mill plows and other parts subjected to abrasive wear from sand, gravel, cement and other abrading substances. By using this alloy, parts and labor costs are lower and equipment down-time is reduced.–**Calumet Steel Castings Corp., 1636 Summer St., Hammond, Ind.** 268D



Now Magnesia Insulation Resists Boiling Water

New form of 85 percent Magnesia (sample E above) for hot piping and equipment resists damaging effect of severe water exposure. View top left shows new material and four other leading insulating materials prior to test. All were subjected to 30 cycles of immersion for 7 hr. in boiling water (top right) followed by drying on steam pipes for 17 hr.; topped off by 168 consecutive hr. of immersion. Lower view shows strikingly different comparative damage.–Magnesia Insulation Manufacturers' Assn., 1317 F St., Washington 4, D. C. 268E

How to lower the cost of elevating



Let LINK-BELT recommend the bucket elevator that meets your requirements from 13 types in 4 basic designs

WANT to cut your cost of raising materials to processing machinery or to storage bins or silos? Regardless of the capacity required — or the characteristics of your material — there's a Link-Belt Bucket Elevator for the job.

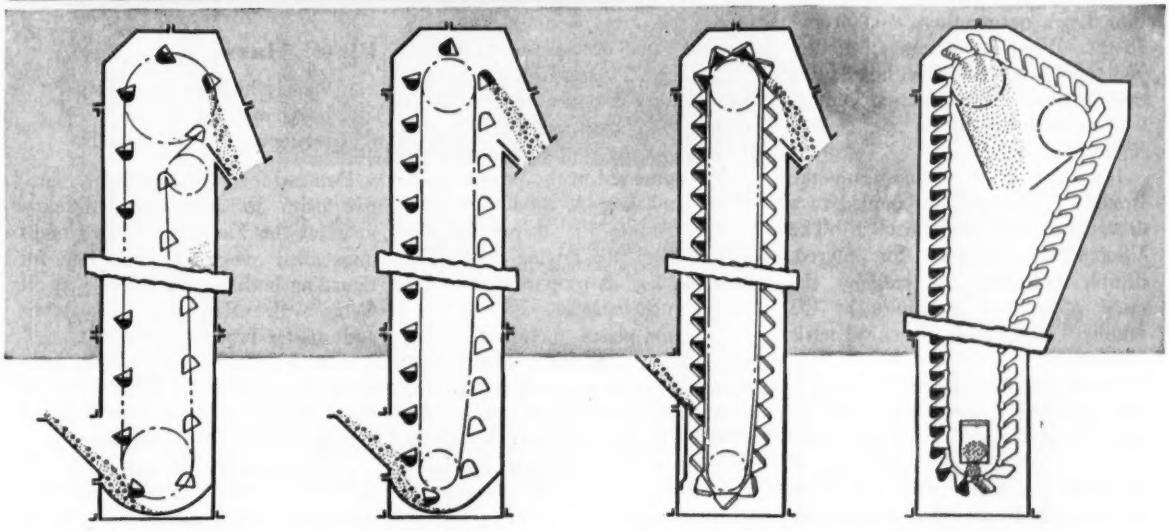
Working with this broad line, Link-Belt engineers can select the one best-suited to your needs. A wide range of sizes on chains or belts is available.

What's more, installation, maintenance and operating costs are low with Link-Belt Bucket Elevators. Rigid, jig-built casings are self-supporting, need only occasional lateral tie-ins depending on height. You have quick access to both head and boot for periodic inspections. Simple screw or gravity take-ups maintain chain or belt tension at all times.

There's an experienced materials handling engineer in the Link-Belt office near you. Call him for complete information.

LINK-BELT
BUCKET ELEVATORS

◀ Four Link-Belt centrifugal discharge bucket elevators, each with 30 TPH capacity, handling cellulose acetate at a large chemical plant.



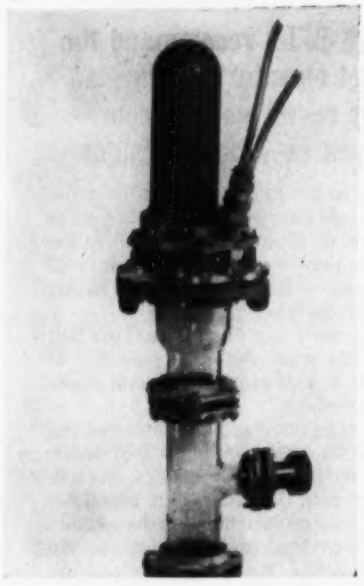
Positive discharge
for light, fluffy, fragile or materials that tend to stick to the buckets.

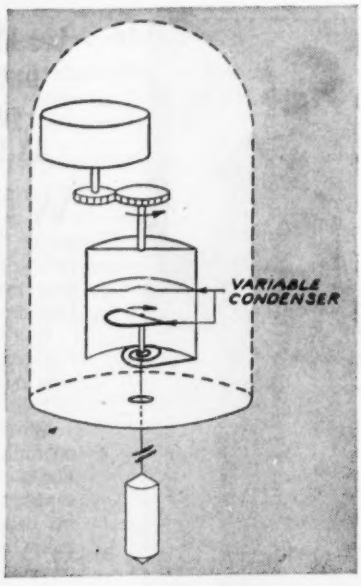
Centrifugal discharge
for free-flowing, fine or loose materials with small to medium lumps.

Continuous discharge
for range of materials —light to heavy, small to large, abrasive lumps.

Internal discharge
for gentle handling of small articles such as pellets, seeds, castings.

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 13,280-B





Through Thick and Thin . . .

. . . this rotational viscometer tells what's happening viscosity-wise. Used with a recorder-controller it guards product uniformity.

In some cases thick may be 20 and thin 2 cps. or in others, 50,000 and 50 cps. Whatever the range, whether Newtonian or non-Newtonian, this new instrument combination permits you to record, indicate and control liquid viscosity.

It's done by a reliable team—the Brookfield Viscometran coupled to a capacitance recorder-controller. The Viscometran designed for rugged, flexible industrial use employs the same operational principles as the familiar Brookfield Synchro-Lectric viscometer.

▶ **Youth and Experience**—Although a new instrument the Viscometran already has performed successfully under a variety of difficult conditions of corrosion and temperature. Products measured and controlled include catsup, paper coatings, starch (conversion process and homogenization), glues, paints, catalyst slurries, crystal slurries, polyvinyl acetate solutions and flour-water mixtures.

It's said the Viscometran makes continuous viscosity measurements with accuracy equal or superior to laboratory determinations. In the Viscometran, viscosity—the measure of a fluid's resistance to shearing stress—is proportional to the torque on a rotating spindle immersed in the process fluid.

▶ **Drag and Lag**—A beryllium-copper linkage permits the driven spindle-shaft to "lag" the driving shaft. The angle of "lag" is proportional to the "drag" on the spindle.

Capacitor plates, mounted on the two shafts, measure the "lag." Changes in capacitance are transmitted by coaxial cable to the recording unit. Sensitive to the smallest changes in capacitance the recorder gives a responsible and reliable measure of product viscosity.

Accuracy of the Viscometran is better than ±2 percent; repeatability measurement is better than 0.2 percent.

▶ **Location**—Instrument must be mounted vertically and can be placed either directly in a vessel or in a sample chamber. Flow-line installations can be made but a flow-line bypass is a preferred location.

Spindle and all immersed surfaces of the unit normally are fabricated of Type 316 stainless steel. Exposed portions of the head are either cast aluminum or stainless steel. Head tilts back easily for easy spindle removal to accomplish cleaning.

▶ **Acclimates**—Where process temperatures are extremely high the unit can be moved away from vessel. An extension then can be used to connect the spindle to the head.

In cases where measurements must be made under pressure an equal purge pressure must be supplied to the Viscometran head. A separate connection is furnished for this purpose. The purge stream of inert gas or air prevents moisture or vapors from entering the head through the lower bearing.

Viscometran also can be furnished with a potentiometer pickup rather than a capacitor. A resistance record instrument is used as a receiver. Although slightly lower in cost than the other model this unit does not have as high a degree of repeatability.—**Brookfield Engineering Labs., Inc., 240 Cushing St., Stoughton, Mass.; 270A**

Flow Alarm

Signals high or low flow being metered with rotameters or manometers.

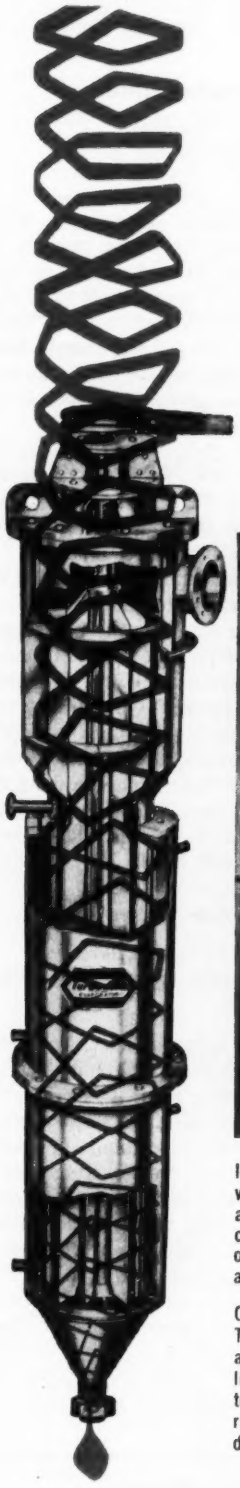
Demand for a fail safe highly sensitive alarm device prompted development of the Flo-Gard. Device offers unequalled range of sensitivity for signalling both high and low flow. It works with rotameters, manometers and similar process instruments.

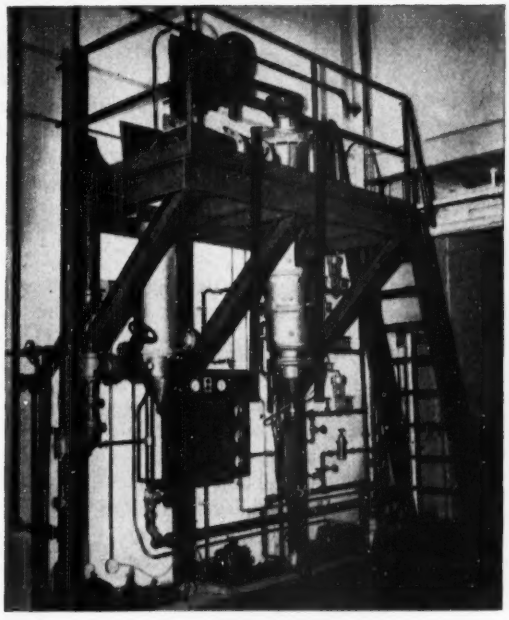
The Flo-Gard can operate accurately in conjunction with spherical floats as small as ⅛ in. It will detect 1 mm. of float position change.

Device consists of a sensing coil mounted on the flow meter, which is connected with a sensing relay. A single tube oscillator circuit provides current flow through a capacitance coupling to energize the sensing relay.

When the metal rotameter float

Distill, Evaporate, Strip, De-odorize, De-aerate with the continuous Turba-Film Evaporator





Installation picture shows the Turba-Film Evaporator, Model No. 2, with capacity for evaporation of 300 pounds of water per hour at 27″ vacuum and 30 p.s.i. steam. Vacuum and steam pressure can be higher or lower at will. Also available are a laboratory unit of 40-pounds-per-hour capacity for trial runs in your own plant and larger models as high as 2500 pounds per hour capacity.

Cutaway figure shows rotor blades running full length of the Turba-Film Evaporator. Material enters at narrow part of the assembly on the indented rotor blades. These convert it to a thin liquid film which is processed during the few seconds required to descend on the walls of the evaporator. Droplets entrained in rising vapor are separated by the blades of the upper section and drop to the heated processing zone below.

The problems of moisture or solvent removal from liquids, slurries and gases give way before the turbulent, thin-film principle of the Turba-Film Evaporator.*

Processing of heat-sensitive, frothy or viscous chemicals, solvents, latices, vitamins and "mycins," juice-concentrates and candies, is *continuously* done in a single, rapid pass.

"Original" or vital properties of heat-sensitive materials are retained. Reduction to desired solids is continuous and automatic. Distillation shows recovery up to 99% plus.

The Turba-Film Evaporator maintains "U" values up to 500, without vapor binding. The unit is substantially self-cleaning; just run it a few minutes with water; other effort is rarely needed. Please send for free brochure giving full information on the Turba-Film Evaporator.
Rodney Hunt Machine Co.,
31 Vale Street, Orange, Mass., U.S.A.

*Turba-Film is a trademark of the Rodney Hunt Machine Co.

RODNEY HUNT®

Manufacturing Engineers Since 1840

PROCESS EQUIPMENT DIVISION

enters the field of the sensing coil it quenches oscillation and stops current from flowing through the coil. As the sensing relay drops out the load relay is also de-energized. This actuates an alarm or performs any other annunciator and control function by means of a double throw, double pole contact.

Two sensing coils may be connected in series to the same alarm unit to provide both high and low flow alarms on a single flow meter or provide separate alarms on two different flow meters. Fail safe features insure operation of the alarm in the event of power or component failure.–**Brooks Rotameter Co., Lansdale, Pa.** **270B**

Hydrogen Sulfide Detector

Continuously detects and measures accurately concentrations of hydrogen sulfide gas.

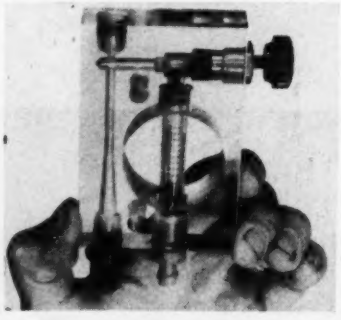
Continuous automatic monitoring of hydrogen sulfide gas concentration is performed by the Type SU detector. It provides both positive control of processes and protection of personnel.

In normal operation the Type SU detector employs two basic steps to produce a measurement of gas concentration. First a series of stains are produced on a paper test strip. Each stain is related in density to the concentration of hydrogen sulfide in a gas sample passed through the strip. Density of the stains produced then is compared to the equivalent density of an unstained test strip.

Stain produced by the test sample is a function of three variables: rate of gas flow into the test chamber, length of time the test strip is exposed to the sample, and the concentration of hydrogen sulfide in the gas tested. By controlling the variables of flow rate and exposure time the difference in density between the stained test strip and a clean test strip is related directly to the hydrogen sulfide concentration in the test sample.

The series of stains is automatically and continuously formed by introducing a fresh portion of test strip into the chamber at predetermined intervals. Density of each stain is electronically measured during the exposure period, the measuring circuit constantly compared to a control circuit to eliminate mechanical errors and the relative density data transferred to an indicating or a charting device.

The detector can be arranged to provide full scale ranges from 200 parts per million maximum to 0.05 parts per million minimum. Obviously, with 0.05 parts per million as full scale it is possible to detect concentrations of a much lower order.–**Viking Instruments, Inc., East Haddam, Conn.** **272A**



Chemical Feeder

Actuated by stream bypass handles small amounts of liquids.

Small proportions of liquid chemicals are simultaneously metered, controlled, mixed and dispensed by a new compact feeder. An ejector, built in the Feedrator, eliminates need for a proportioning pump. All that's needed to operate the unit is sufficient pressure differential in the main line to create a bypass flow through the ejector.

Bypass flow enters at the top of the block, passes down through the ejector creating a partial vacuum on the ejector side. Vacuum induces the reagent to flow through the inlet at the bottom of the block, up through the Flowrator metering tube and on into the mixing chamber.

Reagent flow rate is controlled precisely through manipulation of a needle valve. Should main pressure drop, a ball-check valve prevents backflow of the main stream into the reagent tank.

Four standard models provide reagent feeding capacities ranging from 0.03-0.3 to 2-20 gal. per hr. Unit comes enclosed in a Lucite block, or at some additional cost, Uscolite.–**Fischer & Porter Co., 19 Jacksonville Rd., Hatboro, Pa.** **272B**

Flame Safeguard

Protects gas-fired appliance in case of failure.

Any industrial gas-burning appliance utilizing a constant burning gas pilot can be guarded against damage from failure of the pilot gas or electric supply. The 700 series Saf-T-Flame pilot uses the flame conductivity principle to achieve instantaneous cut off. Use of vacuum tubes is not required.

A small electric current flows betweeen suitable eleectrodes across the pilot flame. This current operates a relay which controls electrically-operated valves in the fuel line.

When the flame is extinguished the current ceases to flow. This instantly cuts off the entire fuel supply.

The Saf-T-Flame pilot conducts sufficient electric power to operate the relays directly. A number of electrodes entirely surround the pilot flame preventing fluctuation or wavering of the flame from breaking the circuit and causing premature tripping of the valves.–**The Partlow Corp., New Hartford, N. Y.** **272C**

Industrial Television

Aided by new small camera connected directly to viewing screen.

A small industrial television camera having high resolution and operating at low lighting levels is in production and now available. It's recommended for watching operations or instruments in any remote dangerous or inaccessible location. Designated Model 300-BV, this camera combines operational stability and constructional ruggedness. It is simple to operate and easily accessible for servicing.–**Diamond Power Specialty Corp., Lancaster, Ohio.** **272D**

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

Lapp Valves are Solid Porcelain

You need to make no compromise with contamination or corrosion from valves in chemical processing. Lapp valves are of *solid* Lapp Porcelain, a material unique as a ceramic for industrial scale chemical service. It alone offers the following combination of characteristics and qualities:

PURITY • Lapp Porcelain is a potassium aluminum silicate, made from selected clays, flint and feldspar...has no free iron or other metallic impurity.

NON-POROUS • Complete vitrification of all sections, through firing to 2300°F., provides *zero* porosity. No dye penetration of body in 100,000 psi test. No chemical can penetrate in service.

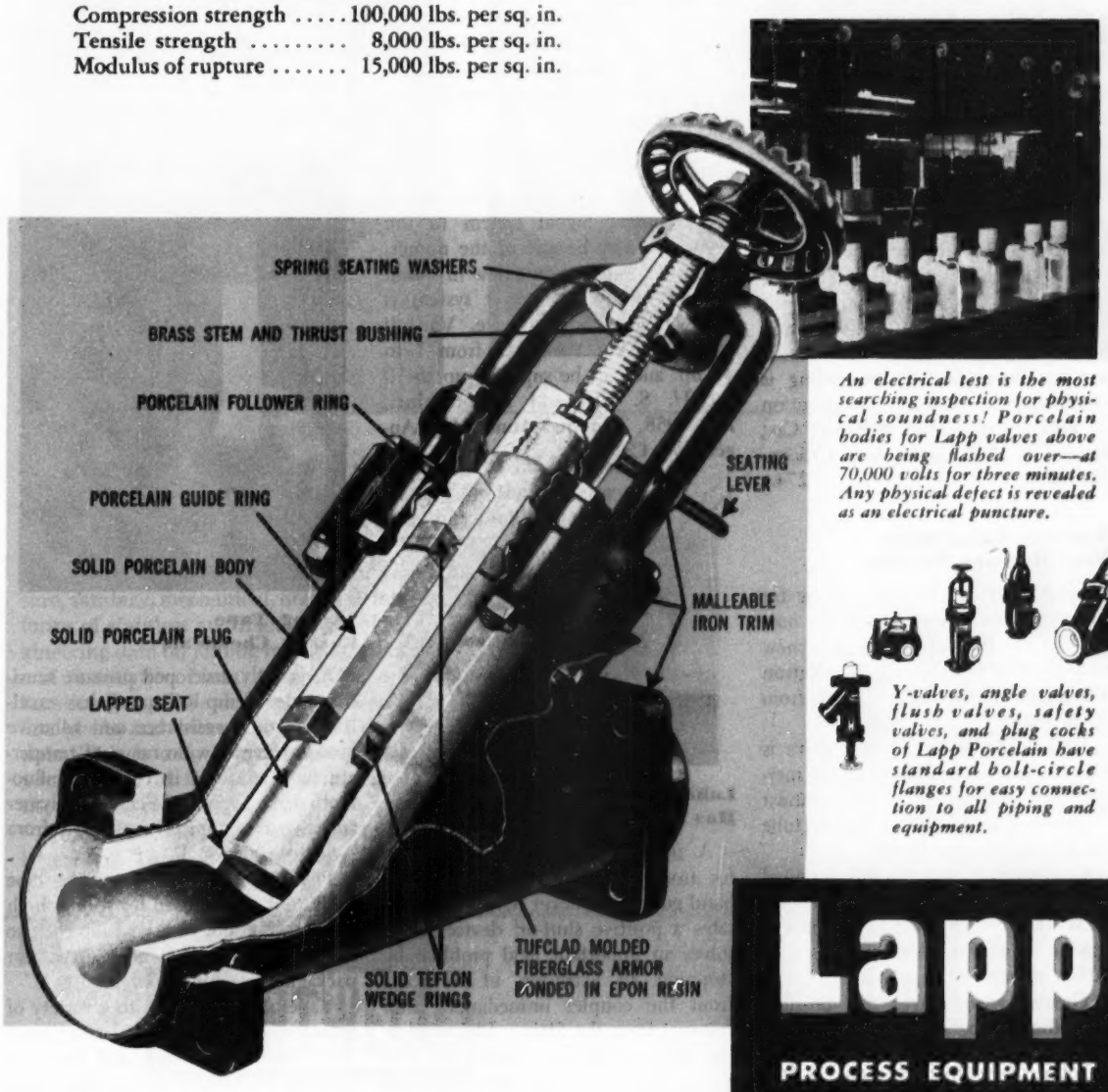
HIGH MECHANICAL STRENGTH

Compression strength ..... 100,000 lbs. per sq. in.
Tensile strength ..... 8,000 lbs. per sq. in.
Modulus of rupture ..... 15,000 lbs. per sq. in.

CHEMICAL RESISTANCE • Lapp Porcelain is unaffected by any acids except HF. It provides years of trouble-free service, handling hot acids in all concentrations, as well as mixed acids and other troublesome combinations.

UNIFORM QUALITY • Lapp Porcelain has been manufactured for 38 years for use in most severe chemical, electrical and mechanical services. Plant facilities include Lapp-patented vacuum processing, deaerating pug mills, two continuous tunnel kilns, and complete chemical, electrical and mechanical test equipment.

Write for bulletin with complete description, characteristics, and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 302 Wendell St., LeRoy, N. Y.



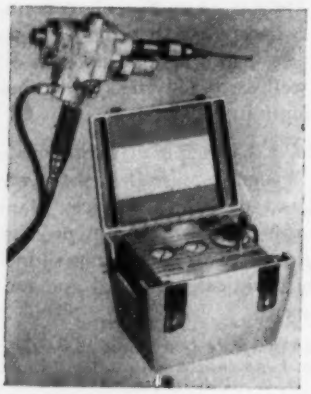
An electrical test is the most searching inspection for physical soundness! Porcelain bodies for Lapp valves above are being flashed over—at 70,000 volts for three minutes. Any physical defect is revealed as an electrical puncture.

Y-valves, angle valves, flush valves, safety valves, and plug cocks of Lapp Porcelain have standard bolt-circle flanges for easy connection to all piping and equipment.

Lapp

PROCESS EQUIPMENT

Chemical Porcelain Valves • Pipe • Raschig Rings
Pulsafeeder Chemical Proportioning Pumps



Tube Rolling Control Assures Uniform Expansion

Electric control now has been teamed with air operation to give more uniform tube rolling. The Electro-Pneumatic tube rolling control is equipped with an air motor. It can roll ferrous tubes up to 2¼ in. I.D. This makes it useful on condensers, heat exchangers, boilers, evaporators, coolers, dehydrators, etc.

Control permits expansion of tube into sheet to degree of tightness and holding strength needed for specific service. Possibility of over-rolling is eliminated. Cold work crystallization is minimized.—**Crane Packing Co., Dept. C4, 1800 Cuyler Ave., Chicago 13, Ill.** 274A

Variable Speed Drive Uses Mercury Rectifier

Controlled variable d.c. voltage for adjustable-speed drive equipment now is available to industry from a new source. First model of the Xatron VS drive will be in the range from 30 to 50 hp.

Basic element in the new drive is a recently developed single-anode mercury-pool rectifier tube. In contrast to gas-filled rectifier, the Xatron tube has a long life expectancy.

Compared to control units designed around rotation conversion equipment, these new units are substantially lighter in weight. Also, for 40- and 50-hp. drives, they are smaller.

Greater speed-ranges are possible with the Xatron unit because regulation at all speeds is within 5 percent. Output voltage can be held accurately at low values. Residual voltage encountered in rotating conversion is eliminated.

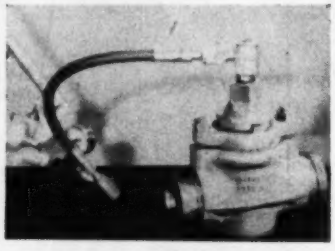
Optional features are quick, smooth stopping; fast reversing; jogging, inching and creeping; and multi-motor drive arrangement.—**Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio.** 274B

Variable Speed Drive Controlled Pneumatically

Variable pressure, temperature, speed, or liquid level working through the Varitrol pneumatic control can regulate the Varidrive variable speed drive.

Control operates on supply air pressure of 60 to 100 psi.; signal air pressure 3 to 15 psi. A unique feature of a Varitrol is the approximate straight-line relationship between signal pressure and speed.

A small sensitive positioner operating on 3 to 15 psi. signal air controls a pilot valve regulating power air to the cylinder. Signal system to the positioner may be any of the numerous control instruments now in standard use. Only the power system is supplied with the Varidrive. Varitrol is available on Varidrives from 1 to 30 hp. and can be supplied up to 50 hp.—**U. S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif.** 274C



Lubricating Coupler Has Positive Shutoff

A new large button-head coupler for use with high-pressure lubricant hand guns and bucket pumps incorporates a positive shut-off device. This solves an important field problem by stopping all extrusion of lubricant from the coupler immediately after removal from the fitting. Identified as the 400 buttonhead coupler the new device has ¼ in. pipe thread pull-on and top connections.—**Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.** 274D

Improved V-Belt Transmits More Power

Horsepower capacity for a new V-belt is claimed 40 percent greater than standard makes now available. Also, the belt is claimed to have longer life.

On new drives, narrower sheaves may be used with the Super-Power V-belt. Belt also has essentially no stretch, which virtually eliminates belt matching problems.

Increased belt strength is obtained with a new synthetic fiber. All rubber used in the belt is synthetic. Belt qualifies as oil-proof, non-sparking, and heat-resistant.—**Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.** 274E

Sealing Tape Resists Chemicals

A recently developed pressure sensitive tape, Temp-R-Tape T has excellent chemical resistance and adhesive qualities over a wide range of temperatures. Tape base is Teflon tetrafluoroethylene resin. A silicone polymer adhesive is completely effective from −80 to 400 deg. F.

Physical characteristics of the tape indicate it will be used for sealing high temperature and chemical ducts. Also it can be used as a facing material for packaging machinery.

Tape adheres readily to a variety of surfaces including glass, aluminum, steel, phenolics, copper and brass. It is being manufactured in widths varying from ½ to 12 in.—**The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.** 274F

IF YOU USE

STAINLESS OR HIGH ALLOY TUBING

this new booklet was written for you...

Whether you're an engineer who wants technical information in a hurry, or a new user of tubing looking for the full story of stainless and high-alloys, you'll find this booklet equally valuable.

In it, discussed by classification, you'll find data on pressure, sanitary, mechanical, heat-resistant, ornamental and other forms of stainless and high-alloy welded tubing. There are engineering data on joining methods, welding techniques, bending and installation hints. Also included are complete tables of bursting pressures, physical and chemical properties of stainless steels and other alloys, and corrosion and temperature data. This is only a partial list of contents, but it will give you an idea of the wealth of pertinent, factual information the booklet contains.

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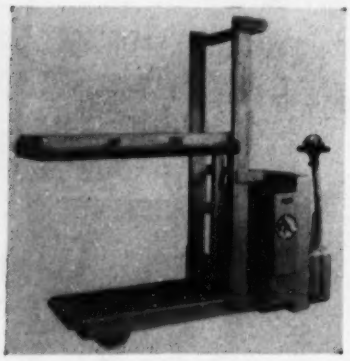
TRENTWELD

STAINLESS STEEL TUBING

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)



Load Stabilizer

Permits speedy handling of skids without fear of package spillage.

A load on this truck is like the filling in a sandwich. Any load handled by the truck is carried on a platform with another overhead platform acting to hold it in place. It makes possible speedy and efficient transfer of skids without fear of spillage.

Inverted platform has a lowered height of 41 in. and a raised height of 67 in. To prevent crushing during lowering of the load stabilizer, an adjustable pressure relief valve is incorporated into the hydraulic system. In addition, the surface of the load stabilizer platform is covered with a heavy layer of sponge rubber.

Load stabilizer has multiple uses and is readily adaptable to any high lift stacking truck.–**Lewis-Shepard, Dept. R-39, Watertown, Mass. 276A**

Electric Fork Trucks

Now have underwriters approval for operation in hazardous areas.

Standard electric Carloader fork trucks now have been modified and are approved by Underwriters' Laboratories for operation in hazardous areas covered by Underwriters' Class I Group D classification. This means these 3,000 to 5,000-lb. capacity trucks can operate in atmospheres containing gasoline, petroleum, naphtha, benzene, butane, propane, alcohols, acetone, lacquer solvents and natural gas.

Modifications that have been made range from insertion of sealing boxes at various points in the electrical circuit to use of static conductive cushion tires. All machines are furnished with plates mounted on the frame, giving the necessary operating instructions. **–Clark Equipment Co., Battle Creek, Mich. 276B**

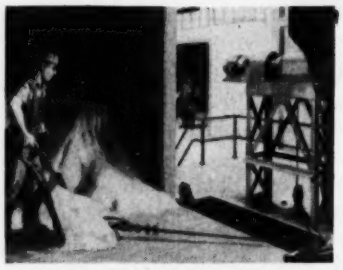
Vapor Cap

In form of tiny plastic spheres now available from second source.

Microballoon hollow plastic spheres recently developed by Standard Oil Co. of Ohio now are available from a second source of supply. These tiny spheres are slurried in oil and pumped into crude oil storage tanks to form a foam-like floating seal on the oil surface. Evaporation losses of crude oil are drastically reduced.

Cosmalite Microballoons are so effective that a layer only ¼ in. thick is sufficient in most cases.

The tiny spheres are made of phenolic resin with nitrogen filling the hollow interiors.–**The Colton Chemical Co., 1545 East 18th St., Cleveland 14, Ohio. 276C**



Scoop Unloader

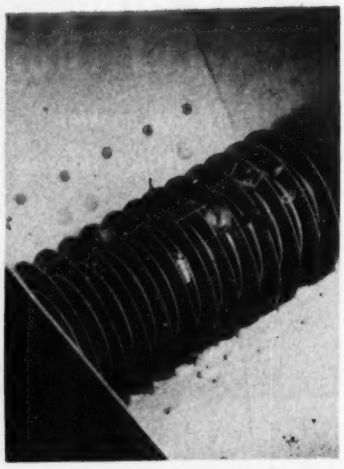
Makes car unloading a safe one-man operation .

Bulk materials can be unloaded safely and speedily by one man using a new automatic power scoop. It is designed for use with box cars unloading into track hoppers, elevators and chutes for belt conveyors. Also, it can be used successfully for reclaiming materials from inside storage.

Unloader consists of a power unit mounted alongside the track connected by a steel cable to the scoop inside the car. Power unit consists of motor, reducer, clutch, drum, and electrical limit switch. Grooved drum holds approximately 40 to 45 ft. of ½-in. wire rope which pulls the scoop through material at 1,500 lb. maximum pull.

Complete control of the unloader is located in the scoop handle, thus only one man is required for the operation.

Control is dead-man type. Any time the operator releases the switch lever, whether intentionally or accidentally, the forward motion of the scoop stops. A cam type limit switch automatically stops the scoop's forward motion at the car door. Rope speed is 180 fpm.–**The Jeffrey Mfg. Co., Columbus 16, Ohio. 276D**



Hopper Magnet

Removes stray metal ahead of bagging machine.

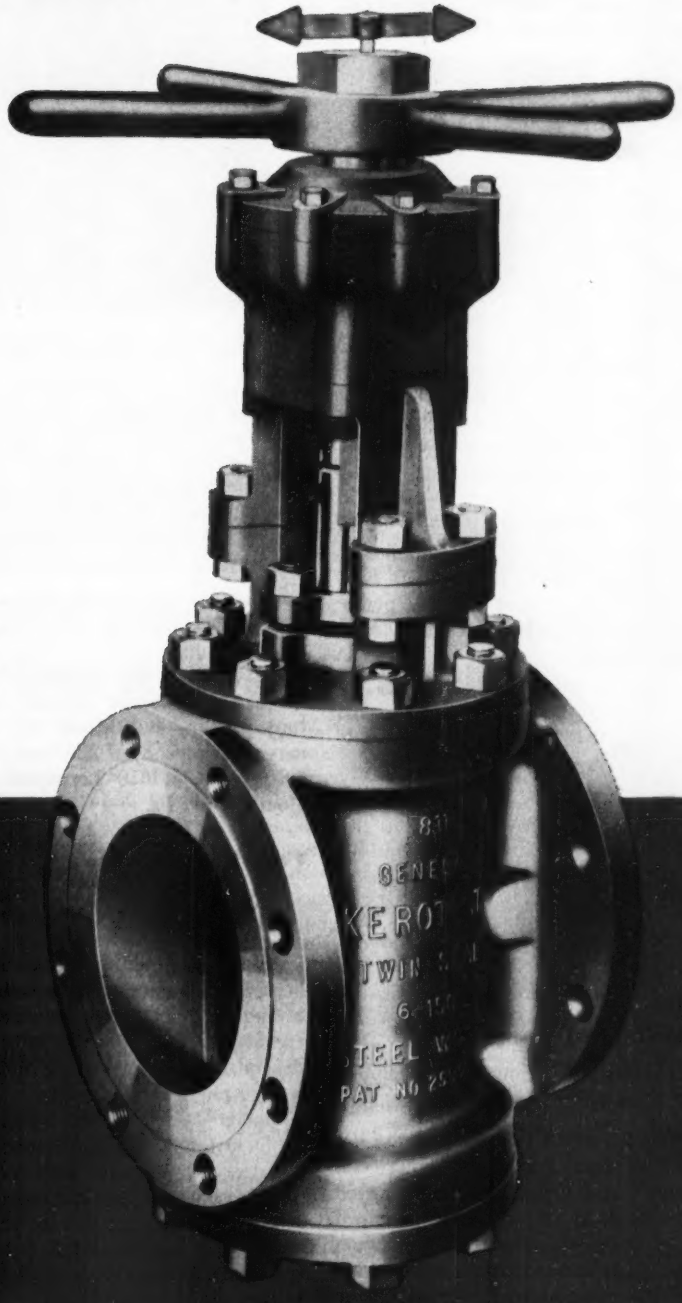
You are looking at a permanent non-electric hopper magnet in the mouth of an automatic bagging scale. Those pieces of tramp metal have been stripped from a down-flowing stream of plastic pellets.

Hopper magnet consists of a series of 6-in. diameter circular magnetic disks spaced at 1-in. intervals around a magnetic core. Because of construction in 1-in. increments, unit can be built in any width desired.

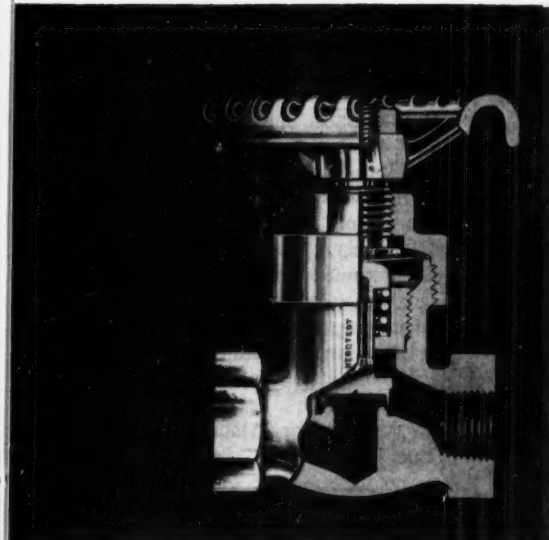
To install, the non-electric permanent magnet is merely laid in the throat of the hopper. It can be freed of iron accumulations simply by lifting it from the hopper and wiping clean with a cloth.

To avoid bridging between disks and ultimate plugging, it is recommended that particles being screened do not exceed three-eights of an inch

KEROTEST



Kerotest R-42 Series valves are manufactured in brass and stainless steels to function at pressures from 350 to 2200 P.S.I. Practical for vacuum service. Write for literature.



A safe steel valve with positive shut-off of both ports. Kerotest Twin Seal valves with Hycar or Kel-F trim are suitable for many chemical applications. Investigate!

KEROTEST MANUFACTURING CO. • 2525 LIBERTY AVE. • PITTSBURGH 22, PENNSYLVANIA

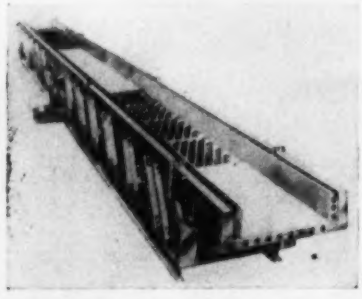
in size. For particles in the range from three-eighth to seven-eighths of an inch, the unit can be provided with 2-in. spacing between disks.–**Eriez Mfg. Co., Erie, Pa.** 276E

Air Lock Feeder

Overcomes flushing difficulties with free flowing materials.

Design of a new heavy-duty rotary air-lock feeder prevents flushing of free-flowing materials through stuffing glands and dust seals. Constructed with 12-in. diameter inlet and discharge, the PAV-12 feeder can handle finely ground or granular abrasive substances. It can remove such products from rotary dryers, coolers, dust collectors, electrical precipitators, bins, hoppers and other process vessels operating at atmospheric or higher pressures.

Unit operates equally well under pressure or suction. It incorporates a new closed pocket rotor and is available with or without packaged power. –**Prater Pulverizer Co., Dept. D, Chicago 50, Ill.** 278A



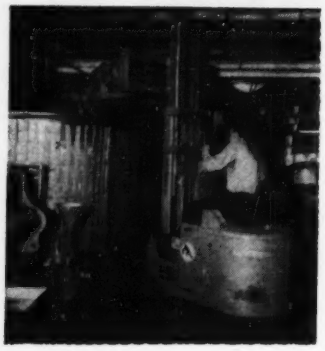
Conveyor

Has two troughs to combine screening and conveying.

Bulk materials handled by the Balanced Dual-Trough vibrating conveyors and screens can be conveyed, screened or conveyed and screened. Conveyors will handle a wide range of materials and conditions of materials.

Conveyors have a low power requirement when running. Amplitude is ⅜ in., and frequency 1,000 per min.

The two troughs or screens are mounted one above the other and connected by leaf springs. The entire assembly, supported on guide links, follows the movement of the eccentric.



From the Third Tier—Into the Tank

Almost every day there's a new story about fork lift trucks. Here is a truck with a drum up-ender attachment. It will lift and carry a drum–then tip it over to empty the contents. On the left the driver has just clamped onto a fiber drum in the third tier. Next you see him tipping the drum to dump contents into tank. Clamping, lifting and dumping all are controlled by operator from his driving position.–Lewis-Shepard, Dept. R-36, Watertown, Mass. 278B

Two models are available: Model 2B has a maximum capacity of 80 tons per hr., and Model 6F has a maximum capacity of 280 tons per hr. –**Syntron Co., 610 Lexington Ave., Homer City, Pa.** 278C

Carbide Elevator

Simplifies the job of recharging generator.

A special carbide screw elevator has been developed for efficient recharging of large double-hopper acetylene generators. Elevator provides a smooth dependable flow of carbide from the storage room to the hopper.

Operator starts the recharging process by turning a switch. Elevator screw transfers carbide either from drums or 5-ton rectangular bulk containers at a rate of approximately 200 lb. per min. When the hopper is full a current type relay in the electrical circuit automatically shuts off power.

An atmospheric vent on the screw housing provides an automatic safeguard. Air is excluded from the generator hopper during the recharging process.–**Linde Air Products Co., 30 East 42nd St., New York 17, N. Y.** 278D

Warning System

Tells operator when magnetic trap needs to be cleaned of tramp iron accumulation.

A new warning system frees the operator's mind of maintenance worries on magnetic separators. A sensitive ferrometer in the Magnalarm constantly measures the quantity of tramp iron as it accumulates on the magnet surface. Once a pre-determined quantity of iron collects, the Ferrometer trips an alarm. Then the operator knows the magnet must be cleaned to provide continued peak operation.

Magnalarm is used with Alnico V permanent magnetic separators which require no wiring or connections. A small amount of current only is required to operate the Magnalarm warning system.–**Eriez Manufacturing Co., Erie, Pa.** 278E

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CHEMICAL PROCESS NEWS

PUBLISHED BY CHEMICAL PROCESS DIVISION, THE M. W. KELLOGG COMPANY MAY 1954

NOTES ON

PHTHALIC ANHYDRIDE

Of interest to chemical processors in general, and particularly in the United States where the irregularity of supply of naphthalene has hampered the production of phthalic anhydride, is the development of a new feed-preparation step in Kellogg's laboratories which permits the use of low-grade, sulfur-containing naphthalene in the Fluid phthalic anhydride process.

***

This step in effect increases the supply of feed available for the Fluid process with its recognized advantages over conventional methods: higher yields . . . lower initial cost . . . easier handling of catalyst . . . longer catalyst life . . . increased safety through better control of heat.

***

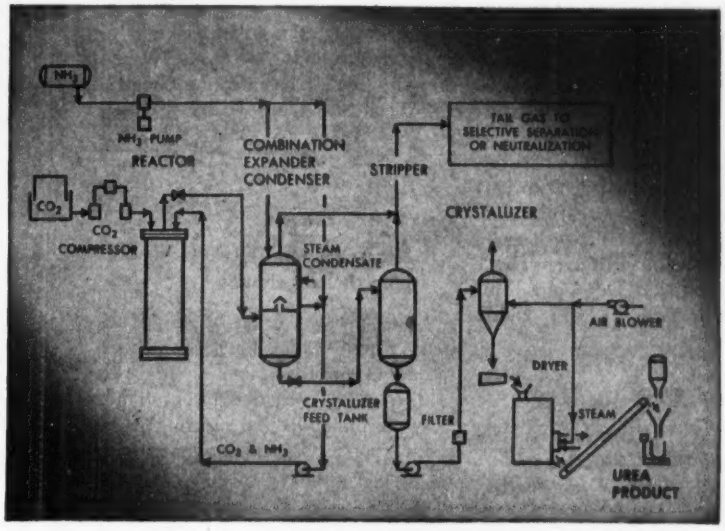
Meanwhile several design improvements are incorporated in new Fluid phthalic plants designed and now being erected by Kellogg. When these units are completed they will produce about 50 million pounds of phthalic annually.

***

While the basic chemistry involved in the oxidation of naphthalene in the presence of a catalyst is well known to chemical manufacturers, new developments in the process for this chemical have not been extensively publicized.

***

One of these is an improved condensing system which may be included under certain circumstances. This not only reduces capital investment but also improves actual operating conditions. It precludes, for example, the need for operators to come in direct contact with the phthalic or its fumes.



Montecatini Process Produces Higher Quality Urea at Lower Investment

The new low-cost method of producing synthetic urea of exceptional purity developed by Montecatini—well-known Italian firm—is shown in the flowsheet above.

Kellogg is the exclusive licensor of the process, a method which reflects more than 30 years of experience in nitrogen chemistry.

One of the most important features of the Montecatini process is virtual elimination of corrosion problems generally associated with urea synthesis. This is accomplished not only through careful selection of materials but also through maintaining a high concentration of ammonia which tends to curb corrosion. Furthermore, relatively mild conditions are employed in the reaction zone in comparison with other urea processes, thus further limiting corrosion.

As a result of these factors, considerable costly alloy equipment is eliminated from many parts of the plant and maintenance expense is held at a minimum.

In addition to these factors affecting the costs of plant and operation it is also of interest that the process produces resin-grade urea without the additional expense of special purification steps. An aqueous solution of 5% urea from a Montecatini plant is clear and colorless, a difficult specification to meet and one which is particularly important for plastics manufacture. A low biuret content of less than 0.01 wt.% is also obtained.

From the standpoint of using the urea as a feed supplement, it is also of importance that no lead-lined equipment is employed in the process, eliminating the possibility of lead toxicity.

For further information, technical data, etc., relating to chemical or petrochemical processing, write

CHEMICAL PROCESS DIVISION
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NEW SAFETY EQUIPMENT

Ammonia Detector

Helps you pinpoint ammonia leakage with ease.

Source of ammonia leakage now can be detected easily within seconds. All you do is light a sulfur-impregnated taper and hold it near equipment suspected of leaking. A white cloud will indicate the point of leakage.

Tapers may be extinguished and reused. They are furnished in a pocket size container designed to be carried in a pocket or hung on the wall near ammonia equipment.—**Nitrogen Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. 280A**

Protective Cream Dispenser

Aids protection of personnel against occupational dermatitis.

This sturdy tamper-proof dispenser reminds men to protect themselves and makes it easy for them to do it. While providing an economical and sanitary means of dispensing antiseptic protective creams, it also protects the product against contamination.

Dispenser accommodates 12-oz. tubes of cream. A predetermined amount is dispensed with each stroke of the lever. Manufacturer recommends dispenser be installed in washrooms so that men will be careful to apply creams only to freshly washed skin area.—**West Disinfecting Co., 42-16 West St., Long Island City 1, N. Y. 280B**

Barrier Rope

Has yellow and black polyethylene strands.

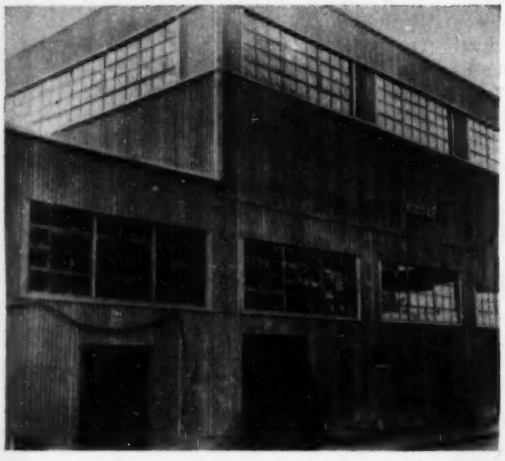
A new plastic barrier rope combines high visibility and long life. Fabricated of polyethylene, rope has two yellow strands and one black strand. It is recommended for erecting barricades around electrical equipment and maintenance jobs within chemical plants.

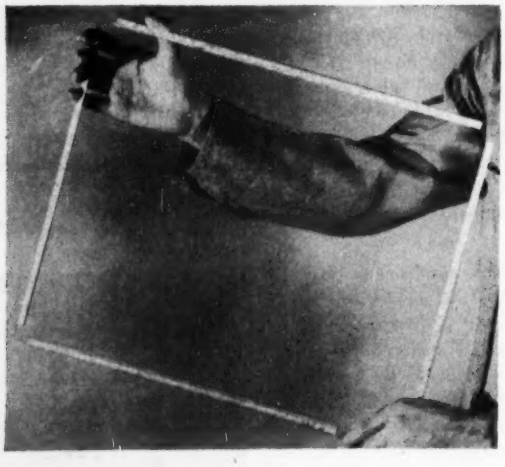
Poly-rope is $\frac{5}{16}$ in. dia. rope that is light and flexible, yet will not sag or stretch. It has excellent dielectric properties, will not support combustion and is not affected by oil.—**Industrial Products Co., 2753 North Fourth St., Philadelphia 33, Pa. 280C**

Sulfur Dioxide Detector

Determines atmospheric concentrations quickly within working area.

An accurate, easy-to-use portable instrument quickly determines sulfur dioxide concentrations from 0 to 50 ppm. in the atmosphere. You merely squeeze the aspirator bulb three times for an adequate air sample. Reagent in the tube turns from blue to white. Length of decolorization is directly proportional to the percent SO_2 in the sample.—**Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa. 280D**

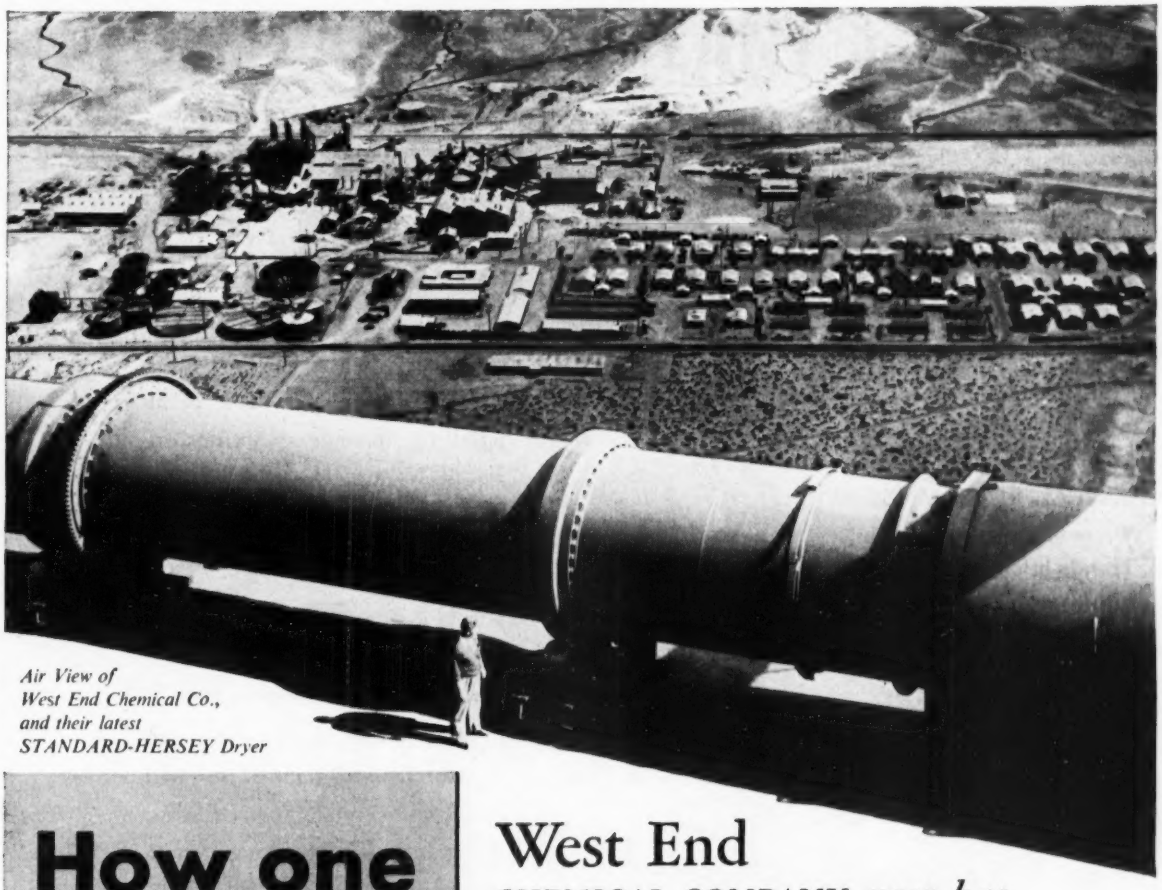




How Extruded Plastic Windows Are Installed to Aid Plant Safety

WINDOWS of building at Emery Industries, Cincinnati, Ohio, are glazed with explosion-vent panes of Tenite butyrate plastic. They are tough but they'll release quickly if there is a sudden pressure buildup inside walls where process is using hydrogen.

PANES for explosion-vent windows are cut from extruded plastic sheeting. Thin galvanized strips are crimped over edges providing a metal binding $\frac{3}{4}$ in. wide. If there is a blast the flexible panes will bow and pull away without shattering.—General Plastics Co., Marion, Ind. 280E



Air View of West End Chemical Co., and their latest STANDARD-HERSEY Dryer

How one GOOD DRYER

LED TO ANOTHER ...and ANOTHER ...AND ANOTHER

West End CHEMICAL COMPANY *now has*

27 STANDARD HERSEY DRYERS

To tap the chemical resources of Searles Lake in California's Mojave Desert, it was necessary for the West End Chemical Company to set up a plant at the source of the raw product. Plant Equipment had to be rugged and dependable because repairs and replacement facilities were many long desert miles away.

Rotary dryers are vital to the West End process of manufacturing borates and soda products. Their first dryer in 1926 was a STANDARD-HERSEY and, with modifications, it is still in use. *West End has since purchased 26 additional* STANDARD-HERSEY *rotary dryers*—proof of STANDARD-HERSEY dependability.

Standard Steel Corporation manufactures more than 30 dryer types. Special equipment can be engineered to fill specific dryer requirements.

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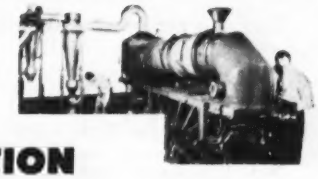
THE STANDARD FOR 52 YEARS

COMPLETE PILOT PLANT TAKES GUESSWORK OUT OF DRYING

STANDARD-HERSEY'S pilot dryers play an important part in solving your drying problems *before* blueprint stage.



STANDARD STEEL CORPORATION

5005 Boyle Avenue, Los Angeles 58 • 7 East 42nd St., New York 5

GUIDED TOUR CONTINUED

PICTURED FLOWSHEET

Synthetic ammonia 332

CHEMICAL ECONOMICS

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New process makes ammonia.

Here are details of a plant handling tonnage quantities of liquid N_2 and O_2. It's the new partial oxidation process for making ammonia. (Page 332)

Chemicals will buck a trend.

McGraw-Hill survey shows that chemical process industries will increase capital expenditures. Plans are for modernization to meet competition. (Page 339)

Bill Sparks, medalist.

Researcher, inventor, administrator. That's Dr. William Sparks of Standard Oil Development, the AIC Gold Medalist for this year. (Page 360)

New technical literature . . .

You can now get—free and fast—literature on any subject in your field. Use our new enlarged section to keep your files up-to-date. (*Reader Service*)

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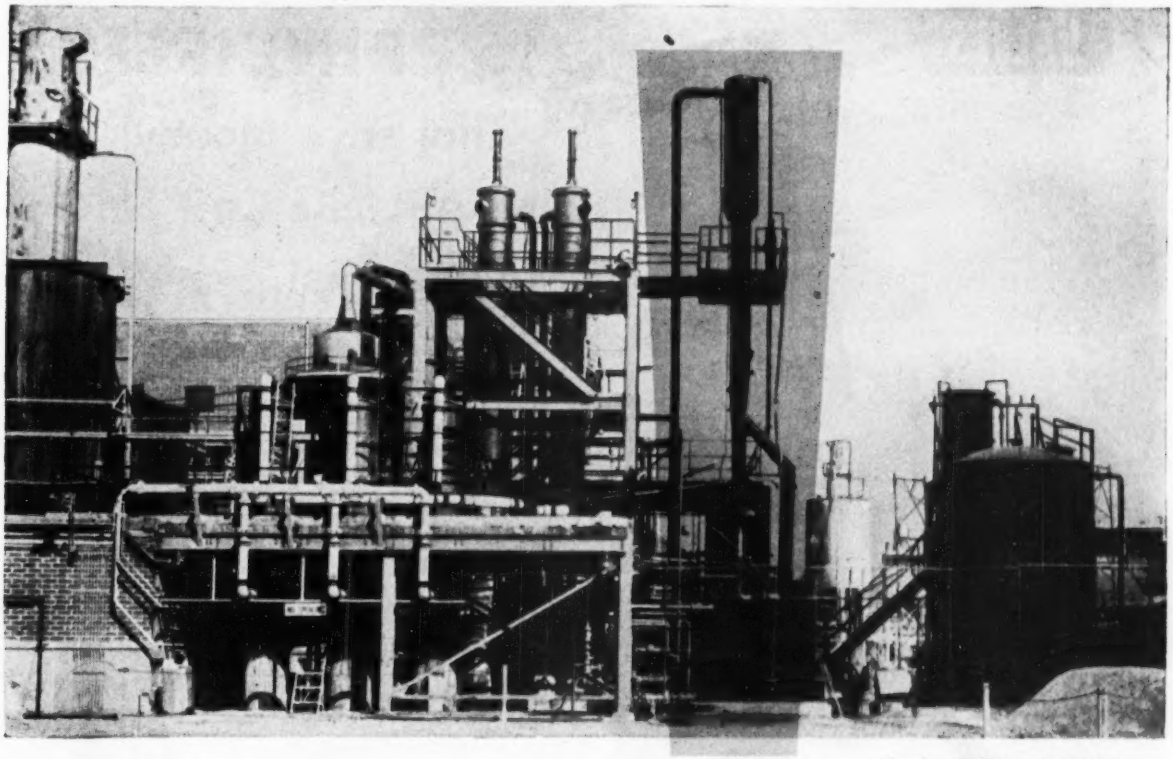
RIEGEL-CAROLINA PLANT depends on I-R STEAM-JET REFRIGERATION



Chlorine dioxide plant of Riegel-Carolina Corp., showing reactors, absorber towers and I-R Steam Jet Refrigeration unit for chilled water at 50°F.

for safe, low cost production of ClO_2

CHLORINE DIOXIDE, long looked upon as a high-cost, 'super' bleach for wood pulp, is now being safely and economically manufactured at Riegel-Carolina Corp.'s Acme, N. C. mill at a rate of one and one-half tons a day.

The ClO_2 gas, generated in three reactors, is absorbed by water passing through two packed towers in parallel. The cooler the water, the more concentrated the solution, with resulting economy. 50°F. water for this purpose is provided by an I-R steam jet water vapor refrigerating unit, regardless of ambient temperature. And the only operating cost for refrigeration is the cost of the steam used in the unit's ejectors.

In addition to the I-R refrigerating unit, the bleach plant is served by I-R chemical pumps, of IRCAMET construction—entirely successful with the corrosive solutions.

This is another example of how Ingersoll-Rand job-engineered equipment serves the paper and chemical industries. I-R experience on thousands of specialized jobs like this is your best assurance of maximum efficiency and economy in meeting *your* exact requirements.

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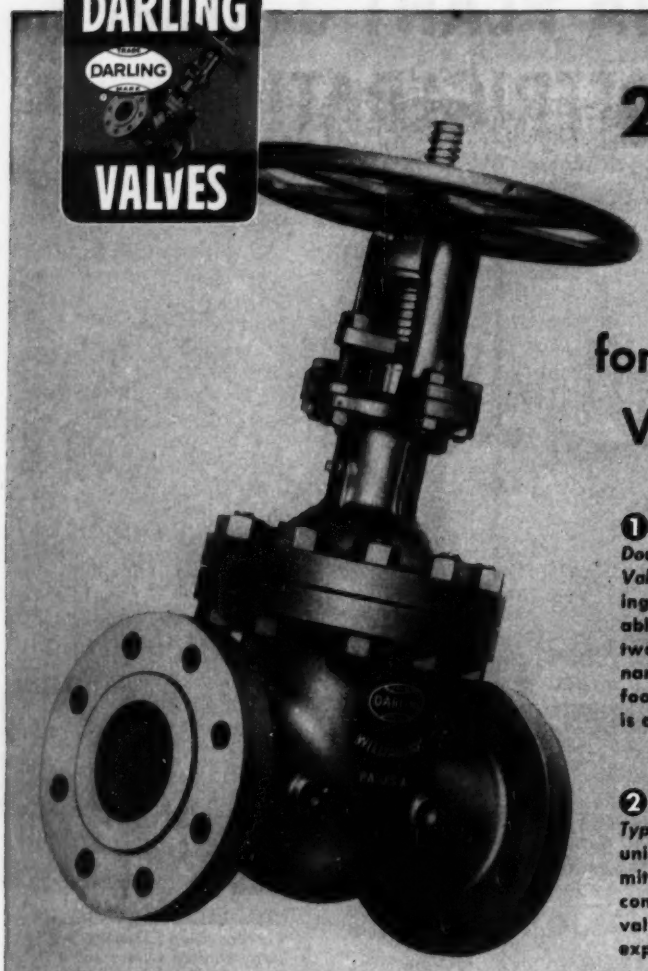
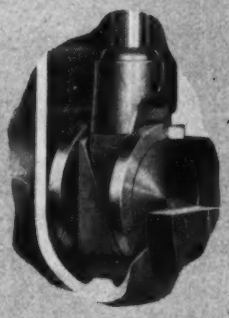
DARLING VALVES



2 VALVE PRINCIPLES that save money for DARLING Cast Steel Valve users!



1 ***Darling Fully Revolving Double Disc, Parallel Seat Gate Valve.*** **Just four simple working parts . . . two interchangeable, no-pocket discs and two husky wedges. Maintenance is easier, assembly is foolproof, and tight seating is assured.**

2 ***Darling Slotted Wedge Type Gate Valve.*** **Notice the unique center slot which permits wedge to seat under compression and adjust to valve seats as valve body expands and contracts.**

Select the DARLING Valve to meet your specific needs

WHETHER you select the fully revolving double disc, parallel seat type . . . or the slotted double grooved wedge type . . . you'll have a Darling gate valve with outstanding features that are minimizing down time and cutting maintenance costs on job after job.

Check cutaway view No. 1. This famous Darling self-adjusting, revolving disc parallel seat gate valve is rated by users as the most trouble-free, best performing gate valve obtainable. Its simple, efficient design assures *automatic* compensation for valve body distortion. In addition, wear on valve parts is *uniform,* which means much longer service life.

Now take a close look at cutaway view No. 2. This Darling valve will do everything that an ordinary solid wedge valve can do . . . *and more.* The wedge is slotted to assure better seating under valve body expansion and contraction. Tight closure and easy operation are assured, and there is far less wear on wedge faces and seats. *Also,* the *double* grooves, with *twin* guide ribs in the valve body, provide twice the usual bearing area. Canting of wedge caused by line pressure is thus eliminated, preventing damage to the downstream seat.

You'll be wise to get all the facts about these two types of money-saving Darling cast steel gate valves before you decide on any valve. Write today for general literature, or request information on your specific valve needs.

NOTE: Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

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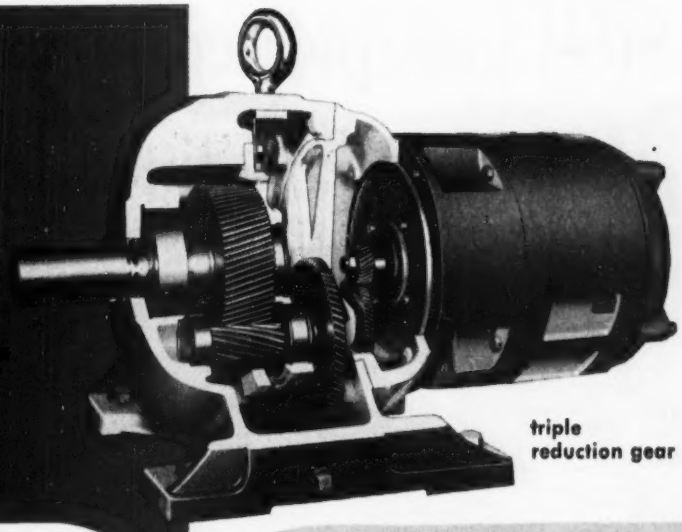


triple reduction gear

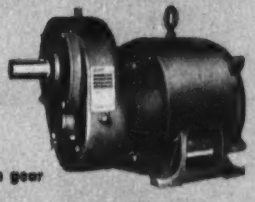
Here's

BUILT-IN SPEED... To Fit Your Need

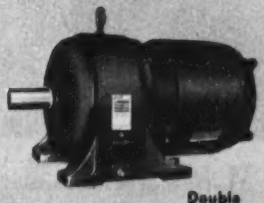
with a complete, new line of

Century Gearmotors

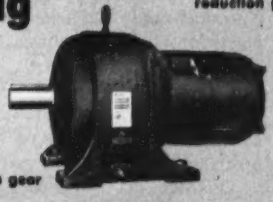
equipped with *Duti-Rated* Precision Gearing



Single reduction gear



Double reduction gear



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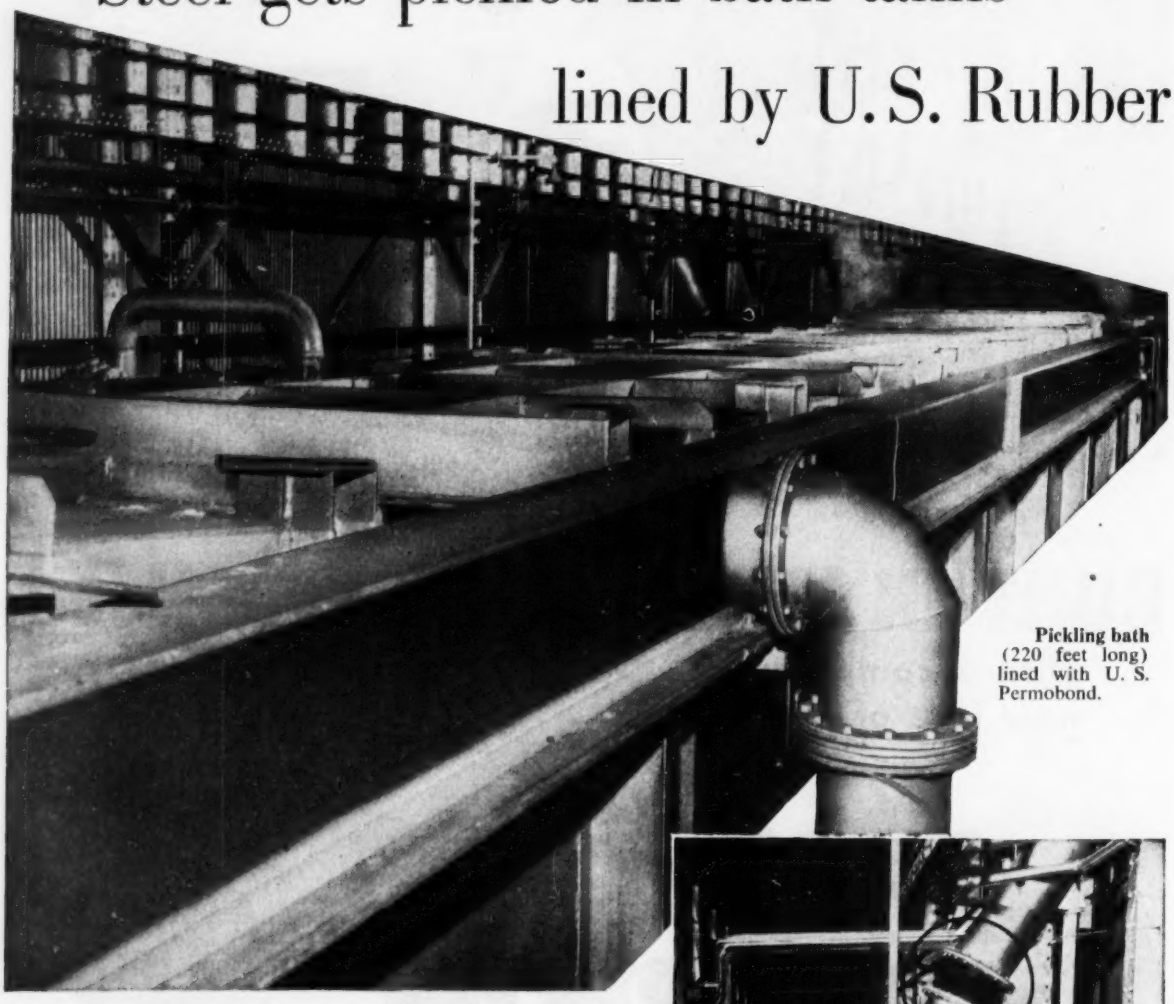
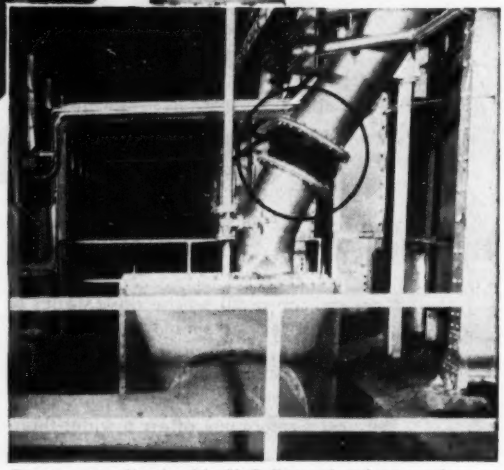
Steel gets pickled in bath tanks lined by U.S. Rubber



Pickling bath (220 feet long) lined with U. S. Permobond.



Duct system lined with U. S. Permobond conveying sulphuric acid fumes to outside of plant. Note U. S. Expansion Joint at right.

Many steel plants handle the hot corrosive acids used in pickling operations by means of tanks lined with Permobond, a product made and installed by United States Rubber Company. Without this rubber, the hot acids would "eat" and corrode the metal tanks.

Typical is this large Midwestern steel plant. The complete pickling unit, acid bath tanks and covers, rinse tanks, fume exhaust system, including a large stack, are all "Permobond-protected."

This steel plant also uses U. S. Expansion Joints to counteract expansion and contraction in pipe lines forming the duct system. And to provide flexibility, U. S. Pilot Flexible Pipe is used in the downcomers.

The "U. S." complete engineering service which designed, accurately fabricated, and Permobond-lined the many complex weldments into a finished, efficient pickling line is available to all industry. Consult any of our 25 District Sales Offices or write to address below.

"U. S." Research perfects it.
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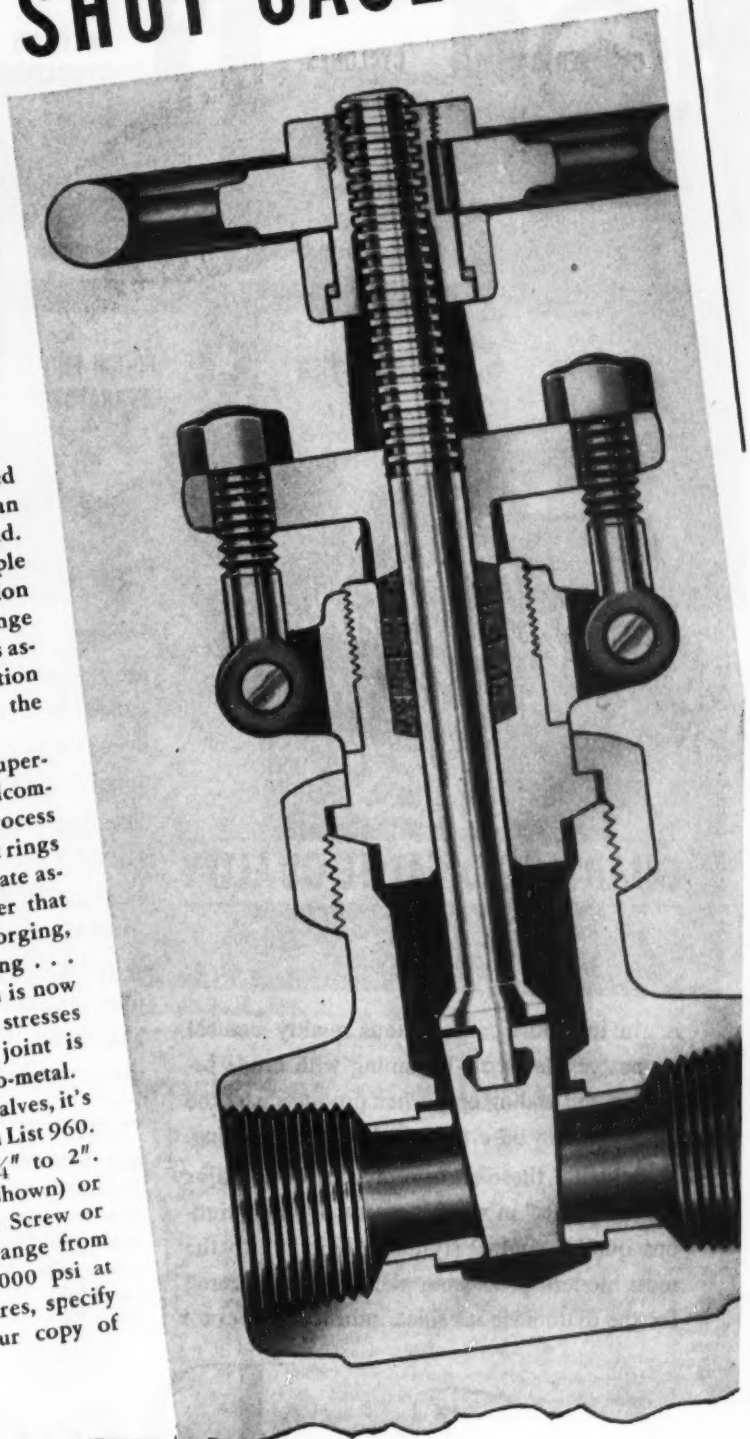
Chapman List 960 is used for more different jobs than any other valve of its kind. And no wonder: its simple and rugged construction means reliability over its wide range . . . super-hardened gate and seats assure tight closure, smooth operation and low maintenance under the toughest conditions.

Here's why: gate faces are super-hardened to 800 Brinell by Malcomizing, Chapman's exclusive process . . . hardened stainless steel seat rings are replaceable . . . stem-and-gate assembly has a tapered shoulder that seats snug in the bonnet forging, permits full-pressure repacking . . . the stem-and-gate connection is now 50% stronger where high stresses can develop . . . bonnet joint is gasketed or ground metal-to-metal.

For big savings on small valves, it's a winning case for Chapman List 960. Available in sizes from ¼" to 2". Rising stem, with yoke (shown) or inside screw, rising stem. Screw or welding ends. Pressure range from 380 psi at 1000°F to 2000 psi at 100°F. For higher pressures, specify List 990. Write for your copy of Catalog 10 now.



The **CHAPMAN VALVE**
MANUFACTURING COMPANY
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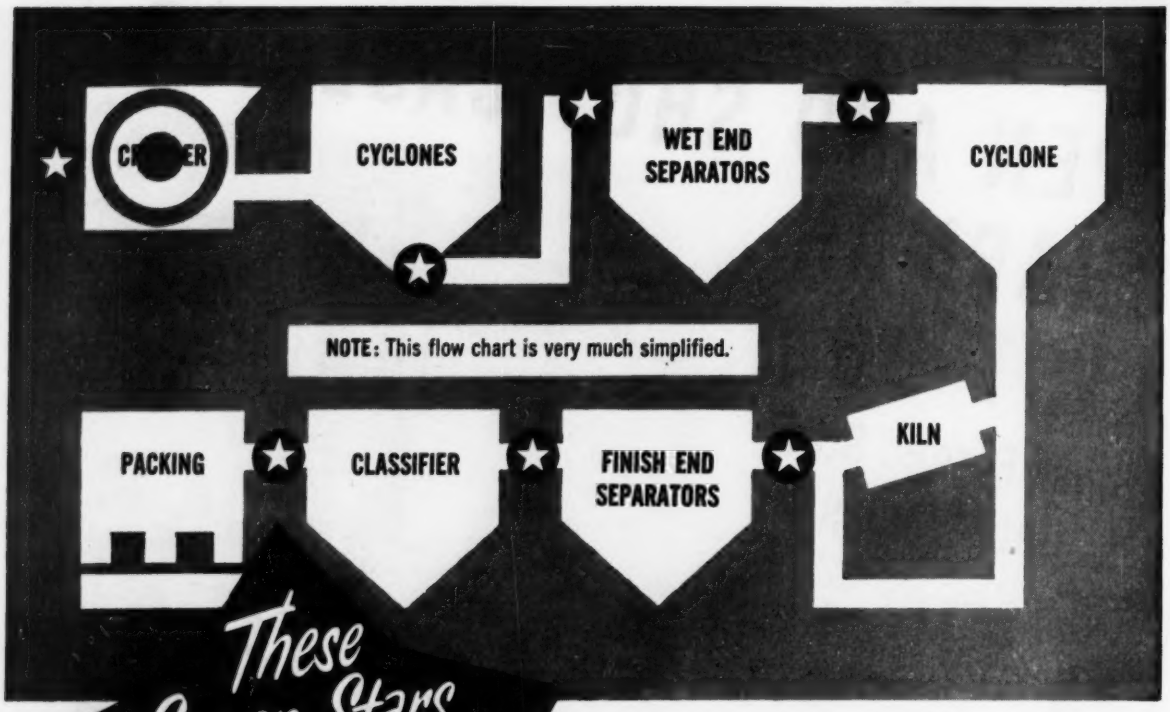

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From this modern control room, every step in the heating, piercing, rolling and reduction of seamless tubes is closely monitored. This is typical of the highly specialized equipment demanded by the Globe precision process . . . insuring high quality and close tolerances.

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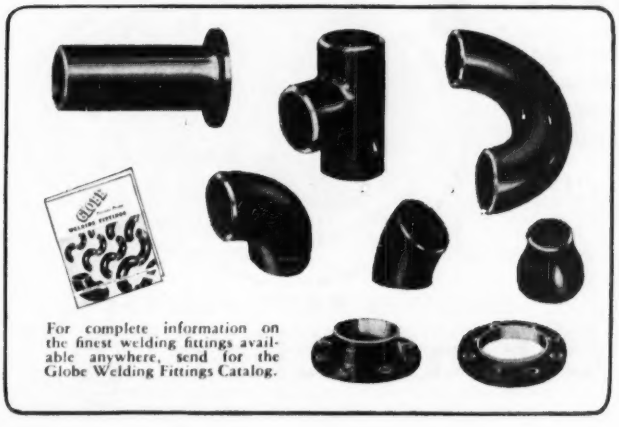

For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

Globe precision-process manufacture *begins with the billet* — continues through the making of the seamless steel tube — (Globe alone among welding fitting manufacturers produces seamless steel tubes) — and extends through to the production of the finished fittings.

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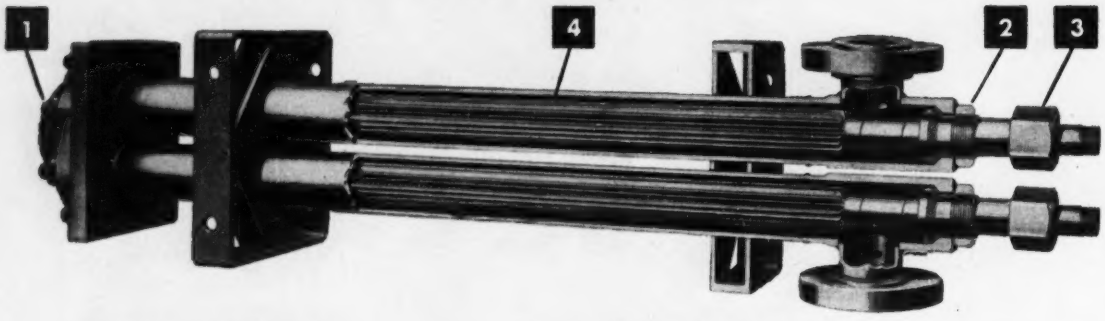
This design provides greater ease of installation, as has been proved in the service of more than 70,000 G-R Twin G-Fin Sections on a greater variety of condensing, cooling, heating and heat exchange services than any other design on the market.



To Remove Element—

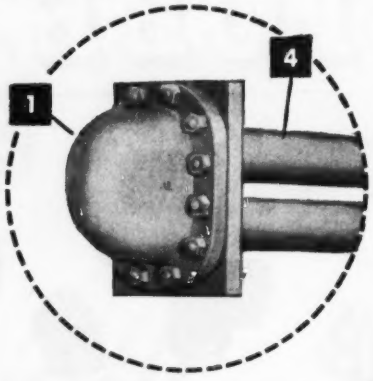
Take off shell cover (1)
Loosen and remove cone plug lock nut (2)
Loosen and remove union nut (3)
Remove element (4)

To Replace Element—

Insert element (4)
Replace and tighten cone plug lock nut (2)
Replace and tighten union nut (3)
Replace shell cover (1)

Domed Shell Cover

This type of shell cover is particularly rugged, yet weighs only 17 pounds for the small sections and 43 pounds for the standard high capacity sections.



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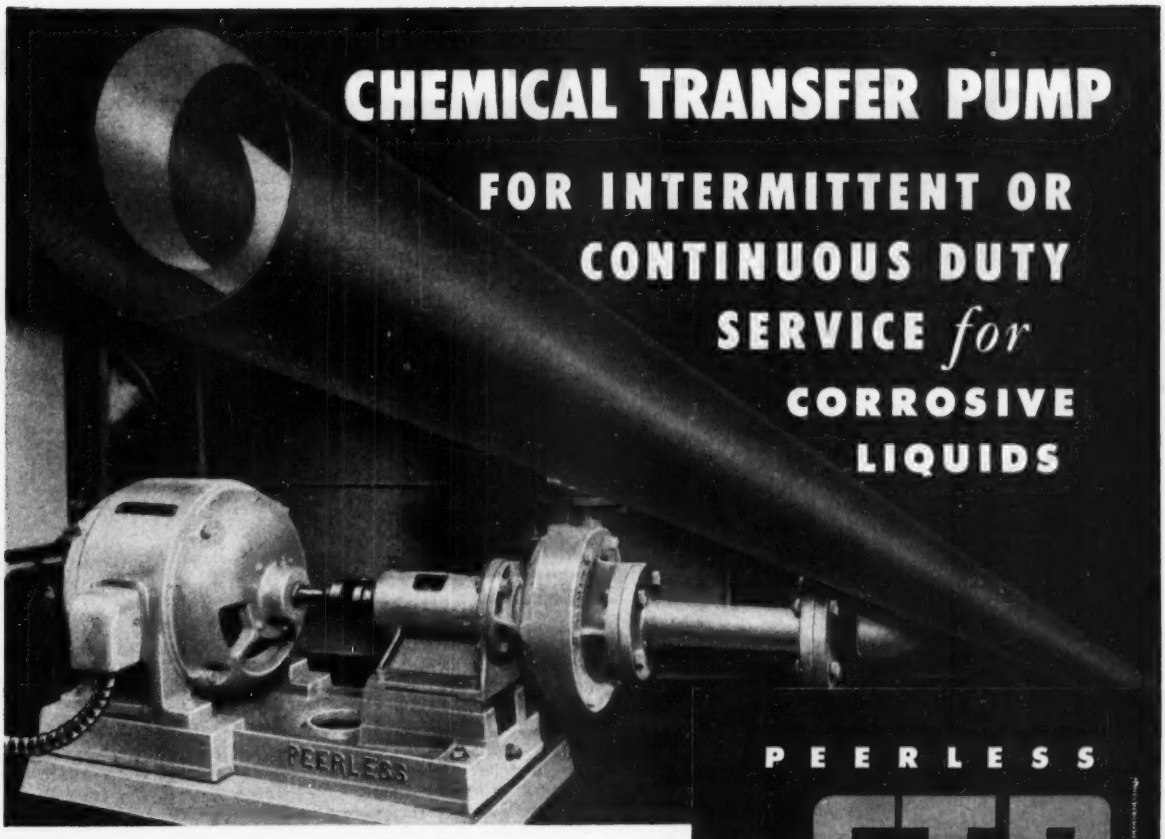
MASSILLON, OHIO

G-R HEAT TRANSFER APPARATUS Twin G-Fin Section

GR-328

CHEMICAL TRANSFER PUMP

FOR INTERMITTENT OR CONTINUOUS DUTY SERVICE *for* CORROSIVE LIQUIDS



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TYPE **CTB**

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TYPE CTB *Features and Advantages:*

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- AVAILABLE FROM STOCK

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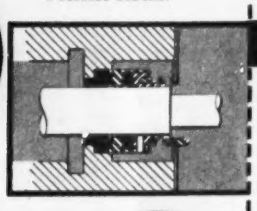
CAPACITY RANGE:	10 to 250 gpm
HEAD RANGE:	10 to 140 feet
HP RANGE:	¼ to 10 hp
CASE PRESSURE:	100 lbs.
LIQUID TEMPERATURE:	Up to 250° F.
MATERIALS OF CONSTRUCTION:	Frame — Cast iron. Liquid End — Type No. 20 stainless steel alloy.

PEERLESS PUMPS



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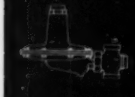
PRESSURE REGULATORS

•



GAS REGULATORS

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LIQUID LEVEL CONTROLLERS

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DIAPHRAGM CONTROL VALVES

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PUMP GOVERNORS

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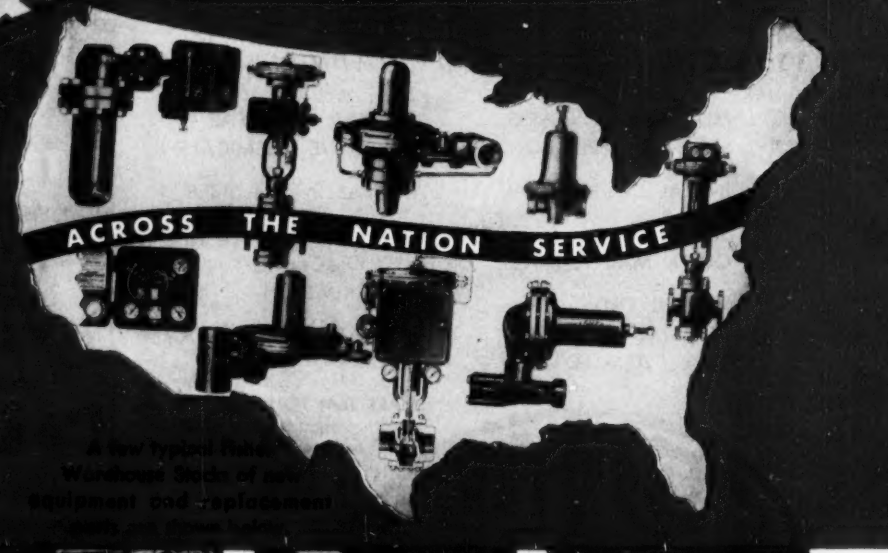
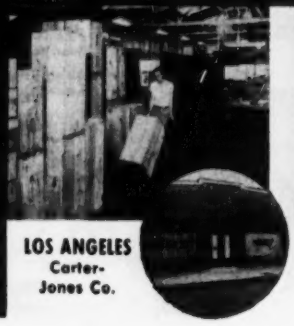
LEVER and FLOAT VALVES





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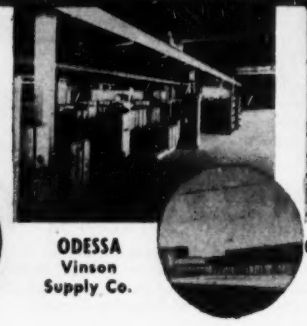

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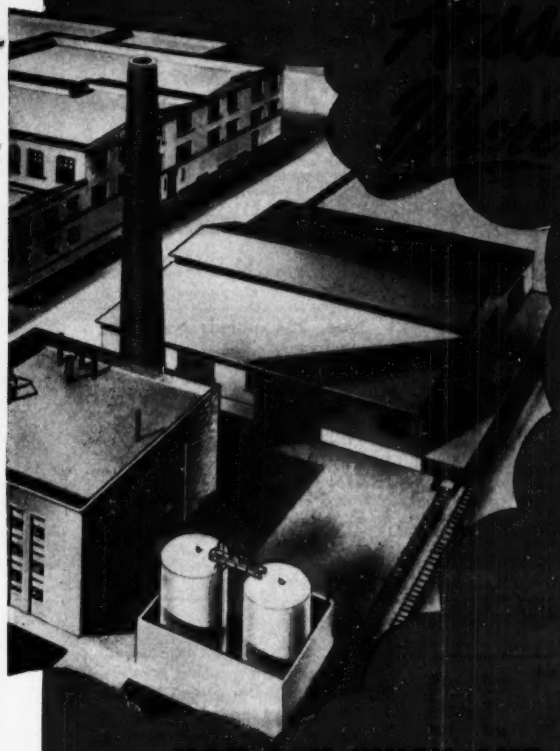
AND FIELD STOCKS



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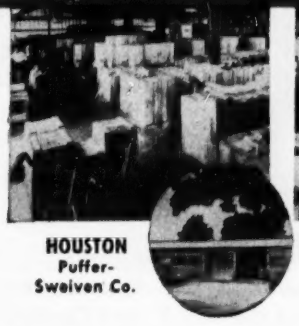

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NEW ORLEANS
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DALLAS
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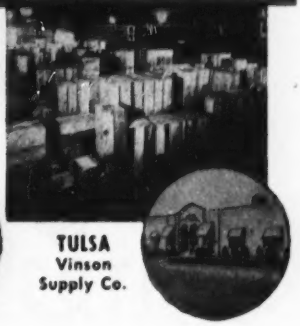

TULSA
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Reports from Users

Showing Typical Results on Corrosion-Control Problems where *Carpenter* STAINLESS No. 20 is used

Corrodent PRIMARY CONSTITUENT	REMARKS	PROCESS	RATING
Aluminum sulfate plus alumina	245°F.	Mfg. of aluminum sulfate.	Excellent, no sign of pitting after 35 working days.
Concentrated chlorine solution	— —	— —	Type 304 pitted. No. 20 satisfactory.
Fluoborate Plating Solutions	— —	Electroplating copper, zinc, etc.	Recommended for use in any of the commercial fluoborate plating solutions.
Maleic acid	30% concentration	— —	Excellent (better than Type 316).
Phosphoric acid	70% phosphoric 5% sulfuric some hydrofluoric boiling acid at 135°C.	— —	Excellent. Corrosion rate obtained: .0180 IPY.
Sulfuric acid	15/50% H_2SO_4 at room temperature	Nozzle for filling storage batteries.	Excellent.
Sulfuric acid	2 to 3% H_2SO_4 room temperature to boiling	Pickling tank.	Under severe working conditions Carpenter Stainless No. 20 showed no appreciable loss of weight due to corrosion (.00012 IPY).
Sulfuric acid	93% H_2SO_4 saturated with sulfur dioxide	— —	Excellent. Negligible corrosion rate (.00006 IPY).
Sulfuric acid	1% to 105% H_2SO_4	Die manufacturing. Heat exchanger coils.	Approx. 8 times as resistant as lead. Expected equipment life 4 years with Stainless No. 20.
Sulfuric acid	10% solution 140/160°F.	Acid dip pickling process.	Excellent.
Wet Chlorine Gas	— —	— —	Not recommended.
Zinc Phosphate	Solution contained approx. 5% sodium chloride at 180°F.	— —	Estimated life 10 to 30 times that of Type 302 or 304. Total exposure during test: 460 hours.

Start now to discover for yourself the far-reaching advantages of No. 20. Drop us a line on your Company letterhead for the No. 20 booklet and for test coupons. THE CARPENTER STEEL COMPANY, 127 W. Bern St., Reading, Pa.

Contact The Carpenter Steel Company, Alloy Tube Division, Union, New Jersey, for Carpenter Stainless No. 20 in the forms of Tubing, Sheet and Plate.

Carpenter STEEL — **Stainless No. 20**

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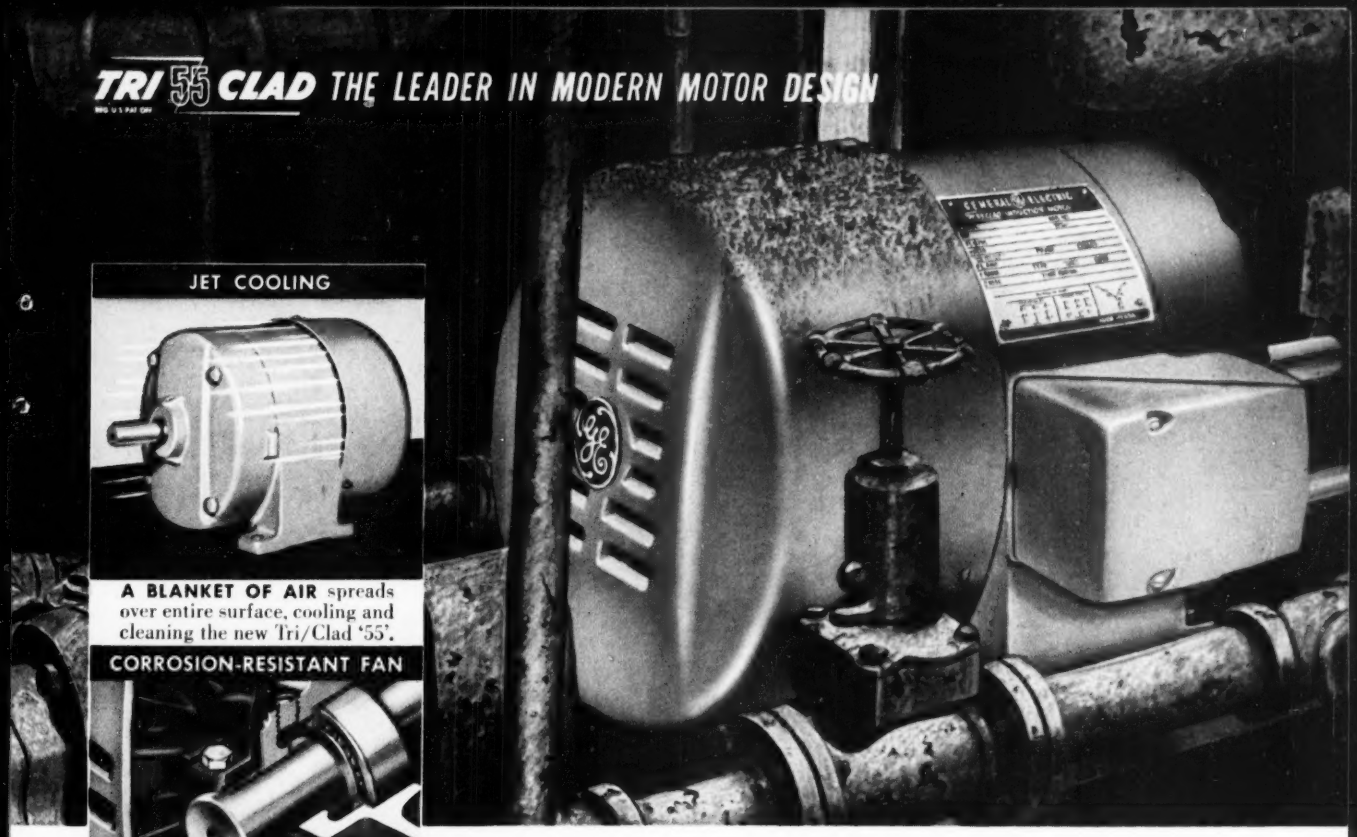
Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U.S.A. and Canada

TRI 55 CLAD THE LEADER IN MODERN MOTOR DESIGN



JET COOLING

A BLANKET OF AIR spreads over entire surface, cooling and cleaning the new Tri/Clad '55'.

CORROSION-RESISTANT FAN

TEXTOLITE* FAN resists acids, alkalis . . . is one of chemistry's vital contributions to the motor.

MOISTURE-PROOF SEAL

SEALING COMPOUND applied on rabbet fits helps to seal out corrosives, moisture and dirt.

FULLY SEALED CONDUIT BOX

RUBBER GASKET waterproofs lead entry to stator of motor. Conduit box is also gasketed.

Now, the new chemical motor . . .

G-E TRI 55 CLAD enclosed motor resists corrosion and moisture!

REG. U.S. PAT. OFF.

General Electric's all-new Tri/Clad '55' enclosed motor meets the tough requirements of the chemical industry. Truly a chemical motor, the Tri/Clad '55' takes advantage of the industry's latest materials including silicone, polyester film, Textolite* and neoprene.

Because it's better protected, this standard motor gives you longer motor life in tough jobs. Frame and end shields are rust-resistant cast iron. Carefully machined rabbet fits are tightly sealed. Rubber gasket protects lead entry to stator.

New insulation materials also add life to this motor. A silicone Dri-film* coating on the stator sheds water—reduces insulation failure due to moisture. New polyester-film for slot and phase insulation is eight times stronger.

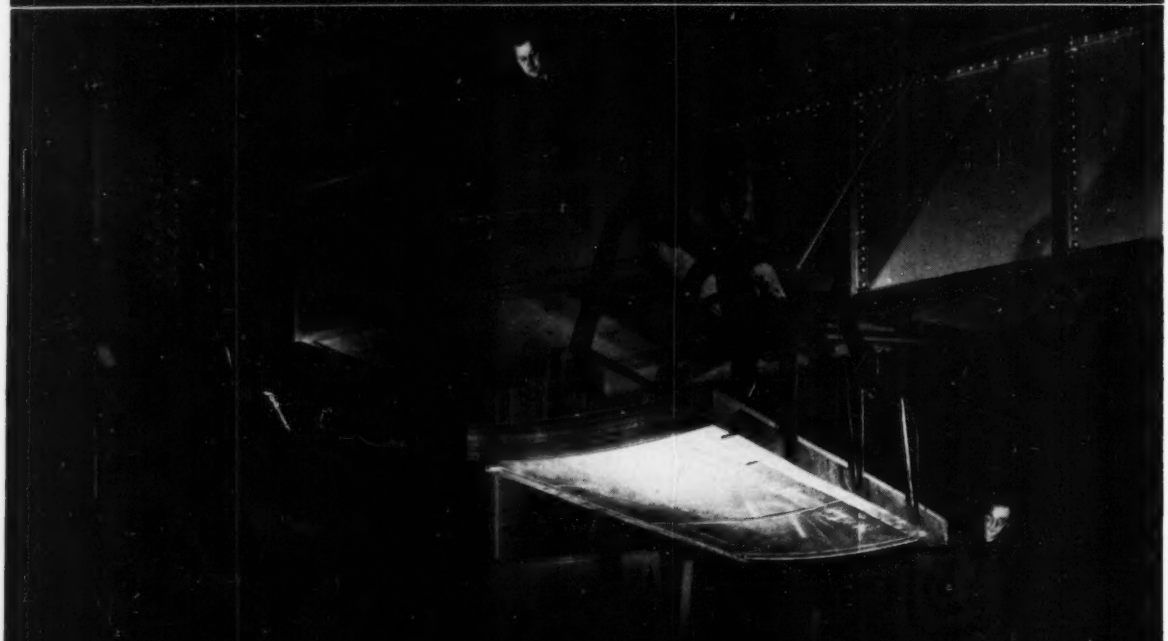
General Electric Tri/Clad '55' motors are available now in many ratings. The entire line, 1 to 30 hp a-c motors, available soon. For full details contact your nearby G-E Apparatus Sales Office or G-E Motor Supplier today. For bulletins on the complete line, write General Electric Company, Section 643-8, Schenectady 5, New York.

*Reg. trade-mark of General Electric Co.

Progress is our most important product

GENERAL ELECTRIC

WHY IT PAYS TO BUY SHEETS and STRIP FROM US



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You needn't worry when you find you're running out of steel sheet or strip and are unable to complete a production run. You can depend on U. S. Steel Supply to rush the needed steel to your plant or shop immediately. And because of the complete stocks in all our warehouses, you can be sure you'll get steel of exactly the same quality and specification you were using. So you don't have to lose costly production time when you need extra steel.

All the sheet and strip we sell bear the famous USS trade-mark—your guide to quality steel. Call us for: hot rolled, cold rolled, vitrenamel, galvanized, galvannealed, paint bond, corrugated, long terne sheets, and hot rolled and cold rolled strip steel.

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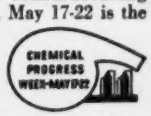
U.S.I. CHEMICAL NEWS

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★

Chemical Progress Week

Sponsored by the Manufacturing Chemists' Association, May 17-22 is the first annual Chemical Progress Week. Its purpose is to bring home to the American public the significance of the chemical industry in terms of the individual. U.S.I. as a member of the MCA, is happy to participate in this industry-wide effort.



Organosodium Compounds Are Opening New Frontiers

Organosodium compounds, made in a liter flask or a 1000-gallon reactor, are opening new, economical routes to the synthesis of phenylacetic acid, dimethyl phenylmalonate, benzophenone, and many others, including organotin, -phosphorus and -silicon products.

The method uses sodium dispersions, which are prepared by suspending microscopic sodium particles (10-20 microns) in various hydrocarbons, such as toluene, xylene or kerosene. High speed agitation is used to disperse the molten sodium in the liquid hydrocarbon.

The organosodium compounds are prepared by reacting organic compounds with the dispersed sodium. Phenyl sodium, for instance, is made by metering chlorobenzene into the sodium dispersion. The minute particles permit the reaction to start immediately and give high yields. Alaphatic, aromatic and heterocylic derivatives can be formed in this manner.

For more detailed information, write for U.S.I.'s new Sodium Dispersion Booklet.

Germanium Is Refined To Almost 100% Purity

A new, simple process reportedly refines germanium to practically perfect purity. It is also being used to refine various metals, organic and inorganic substances.

Germanium from the process may well be the purest material in existence. It is said to have only one atom of impurity in ten billion atoms of the material — about the same as a pinch of salt in 35 freight cars of sugar.

Plastic Coating Protects Big Chemical Equipment

A plastic protective coating can extend service life and cut maintenance costs of large chemical processing equipment. The baked-on coating is said to resist exhaust gases containing corrosive chemicals and inhibit rust and blistering of metal surfaces.

Highly adhesive to metal surfaces, the coating is uniformly applied and then fused by baking. The coatings vary in thickness from 1/32 to 3/16 of an inch and form a continuous protective sheath over crevices. According to the manufacturer, cast iron duplex strainer bodies weighing 1,200 pounds have been protected in this manner.

Use of Methionine Saves Lives In Study of Newborn Disease Caused by Rh Incompatibility

Shows Promise in Other Obstetrical Complications

Methionine shows excellent promise in the treatment of hemolytic disease (erythroblastosis) of the newborn, an often fatal disease caused by Rh incompatability. In a preliminary study, 66.6% of babies whose mothers had taken methionine were saved, as compared with 5.25% surviving for cases refusing the prenatal treatment. These percentages are based on cases classified as severe by the clinicians.

Hemolytic disease is accompanied by damage to the liver of the unborn child. Normal liver functions can be maintained only when the body obtains enough protein, and the amino acid methionine, a component of protein, is needed by the body to metabolize protein itself. Previous investigations have shown that methionine helps to protect the liver from damage, even when the protein intake is low. This led to the belief that methionine might be valuable in the treatment of hemolytic disease and other obstetric complications associated with liver damage of the mother and newborn.

Cases involving many pregnant women suffering from Rh incompatability were studied. Most of the women had lost children previously as a result of the disease. All were offered the chance to take methionine, but less than half decided to do so. Those not taking methionine were studied as a control group for purposes of comparison.

Methionine Administered Orally

At the first signs of Rh-factor complications, the women who volunteered to take methionine were given 5 grams of the amino acid in capsule form each day (equivalent to that found in 5 quarts of milk). The researchers believed that the unborn offspring would use this extra methionine as a protection against liver damage. This treatment was continued until pregnancy was terminated. As mentioned previously, two out of

MORE

Five New Intermediates Available to Industry

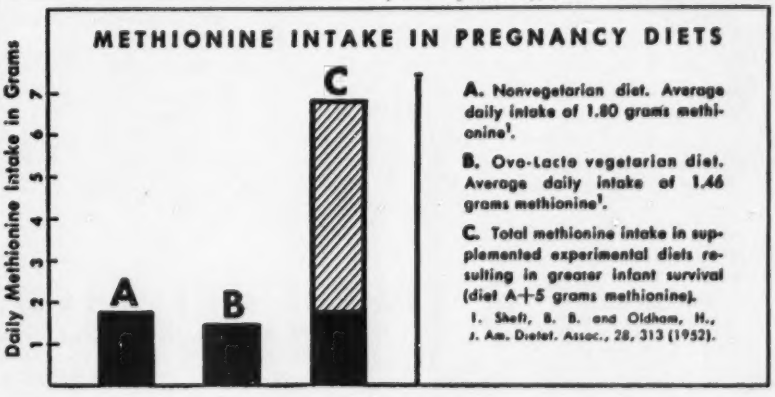
Five new chemical intermediates are available from U.S.I.: Allyl Acetone; Ethyl Chrysanthemumate; 2,5-Dimethyl Hexadiene-2,4; Ethyl-α-Allylacetoacetate; and Ethyl Diazoacetate. They are potential building blocks for such products as pharmaceuticals, perfumes, fungicides, insecticides and fine chemicals and themselves are intermediates in U.S.I.'s complicated 18-step industrial synthesis of allethrin.

Except for Ethyl Diazoacetate, commercial and experimental quantities are available to industry. Ethyl Diazoacetate will not be available as such unless current studies show that it can be shipped and stored safely. However, U.S.I. has extensive facilities which can handle large quantities of the versatile chemical safely and is prepared to make these facilities available to other manufacturers for the synthesis of various derivatives.

Technical data sheets describing the intermediates can be obtained by writing Department D, U. S. Industrial Chemicals Co.

Invisible Markings Made By Fluorescent Pencils

Fluorescent pencils are recommended for any place where invisible instructions or identification treatment is wanted. According to the manufacturer, markings are invisible on white or light surfaces, but will fluoresce a brilliant green when activated by blacklight.


METHIONINE INTAKE IN PREGNANCY DIETS
Daily Methionine Intake in Grams
1
2
3
4
5
6
7
A
B
C
A. Nonvegetarian diet. Average daily intake of 1.80 grams methionine[1].
B. Ovo-Lacto vegetarian diet. Average daily intake of 1.46 grams methionine[1].
C. Total methionine intake in supplemented experimental diets resulting in greater infant survival (diet A+5 grams methionine).
1. Sheft, B. B. and Oldham, H., J. Am. Dietet. Assoc., 28, 313 (1952).

U.S.I. CHEMICAL NEWS

CONTINUED

Methionine Saves Lives

three newborn whose mothers took methionine survived, as compared with about one in twenty surviving when methionine was not taken by the mother.

Other Complications Studied

The authors also studied the value of methionine in treating other types of obstetrical complications associated with liver and kidney damage. These were toxemia of pregnancy, postdelivery shock and inflammation of the liver. The results in these studies were also encouraging.

Toxemia implies the presence of toxic substances in the blood. The tendency towards insufficient protein intake during pregnancy becomes more pronounced during toxemia. This condition is reported to cause more deaths than any other complication in obstetrics. In the work reported, a beneficial diuresis to alleviate the toxemia followed the administering of methionine to patients. Kidney function seemed to be improved. In some cases, this happened after ordinary medication had failed. Edema associated with impaired kidney function also was relieved after methionine had been given.

Methionine assisted in the treatment of postdelivery shock and inflammation of the liver. Postdelivery shock can bring about impaired functions of the liver and kidney which sometimes lead to permanent damage.

Obstetrics is one of the many fields of medicine where methionine is being used in increased amounts.

Adhesives Set Under Water

Adhesives which set under water were recently announced. Said to give good adhesion to metals, glass, paper, fabrics and plastics, the new products remain pliable, yet retain their adhesive strength at temperatures ranging from −55 to over 250° C.

Ointments Protect Skin From Chemical Irritants

Two new types of ointments which protect the skin against various industrial irritants have been marketed.

The first resists organic solvents and solvent-borne irritants. It contains a modified carbohydrate gum base. When dry, the protective gel is said to form a continuous elastic film which adheres to the skin.

The other type is designed to protect the skin from water solutions and water-borne irritants. Two creams of this type are available. They are described as plasticized combinations of ethyl cellulose and castor oil in mixed propanols with a water-repellent vanishing cream base. The creams form invisible, water-insoluble coatings on the skin which withstand normal washing with soap and water.

Safety Instrument Runs Quick SO_2 Determinations

A portable instrument for quickly determining sulphur dioxide concentrations is said to be exceptionally accurate and easy to use. The maximum allowable concentration of SO_2 in working atmospheres is 10 ppm for an 8-hour exposure. The new device determines concentrations of from 0 to 50 ppm.

The manufacturer of the safety apparatus expects it to be valuable in such process industries as petroleum refining, chemical processing, and paint and pigment.

New Dust Collector Holds Fine Particles

A newly developed dust collector is designed for applications where extremely fine particles are involved or where the material must be collected in a dry state.

The cleaning cycle is described as continuous, with the cleaning media being automatically reconditioned by a jet of high pressure air forced through the cloth.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Tweezers which operate on a plunger principle and can pick-up oddly shaped objects have been marketed. They are said to be ideal for highly polished or sterile pieces. **(No. 1030)**

A new drug for ulcer treatment has been introduced. Clinical and animal tests are said to have shown that the compound has a powerful effect in reducing the secretion of acid in the stomach, instead of merely neutralizing the acid already secreted. **(No. 1031)**

Radioactivity absorbers are available which can be used to determine energies of photons and beta radiations, check isotope purity, identify radioactive species, and count a radioisotope in the presence of another. **(No. 1032)**

A new moisture meter is said to measure surface moisture in powdered, granulated or fibrous material in less than 2 minutes and to be accurate to 2% of surface moisture as compared to standard air-dried surface moisture results. **(No. 1033)**

A quick-acting electronic cleaner for contacts, controls and tuners in television sets, radios and record changers has been developed. According to the company, the product eliminates noise caused by dirt from volume controls. **(No. 1034)**

A new caulking compound comes in tape form. Supplied in a variety of widths and thicknesses, the tape is described as both a corrosion inhibitor and vibration cushioner. It can be painted over, or even baked, after application. **(No. 1035)**

Liquid resins for use in the production of reinforced plastics tooling are available. The manufacturer states they can be used in combination with fiberglas fabrics in making spotting racks, checking fixtures and assembly jigs. **(No. 1036)**

Thiophenol is being produced in semicommercial quantities. It is expected to find use in such products as pharmaceuticals, dyes, polymerization regulators and oil additives. **(No. 1037)**

A liquid synthetic rubber spreads easily like paint and rubberizes at normal temperature. Designed for home and industrial repairs, the product is reported to form a flexible film that adheres to plastic, metal, wood, fabric and glass. **(No. 1038)**

A pocket-sized magnet can be used as a recovery tool by anybody who works with metal. The self-contained instrument can be attached to a rope or wire and lowered in vertical pipes, water, barrels and other inaccessible areas. **(No. 1039)**

PRODUCTS OF U.S.I.

ALCOHOLS
- Amyl Alcohol (Isoamyl Alcohol)
- Butanol (Normal-Butyl Alcohol)
- Fusel Oil — Refined
- Propanol (Normal-Propyl Alcohol)

Ethanol (Ethyl Alcohol)
- Specially Denatured—all regular and anhydrous formulas
- Completely Denatured—all regular and anhydrous formulas
- Pure—190 proof U.S.P., Absolute—200 Proof
- Solox*—proprietary solvent—regular and anhydrous

ANTI-FREEZE
- Super Pyro* Anti-Freeze
- U.S.I. Permanent Anti-Freeze

ETHERS
- Ethyl Ether, U.S.P.
- Ethyl Ether, Absolute—A.C.S.

ACETONE—A.C.S.

ANSOLS
- Ansol* M
- Ansol* PR

ACETIC ESTERS
- Amyl Acetate—Commercial and High Test
- Butyl Acetate
- Ethyl Acetate—all grades
- Normal-Propyl Acetate

OXALIC ESTERS
- Dibutyl Oxalate
- Diethyl Oxalate

PHTHALIC ESTERS
- Diamyl Phthalate
- Dibutyl Phthalate
- Diethyl Phthalate

OTHER ESTERS
- Diatol*
- Diethyl Carbonate
- Ethyl Chloroformate

RESINS (Synthetic and Natural)
- Arochem*—modified types
- Arofene*—pure phenolics
- Aroflat*—for special flat finishes
- Aroflint*—room temperature curing phenolic
- Aroplaz*—alkyds and allied materials
- Aropol*—copolymer modified alkyds
- Ester Gums—all types
- Natural Resins—all standard grades

INSECTICIDE MATERIALS
- Allethrin
- CPR Concentrates: Liquid & Dust
- Piperonyl Butoxide
- Piperonyl Cyclonene
- Pyrenone* Concentrates: Liquid & Dust
- Pyrethrum Products: Liquid and Dust
- Rotenone Products: Liquid and Dust

INSECTIFUGE MATERIALS
- Indalone*
- Triple-Mix Repellents

INTERMEDIATES
- Acetoacetanilide
- Acetoacet-ortho-chloroanilide
- Acetoacet-ortho-toluidide
- Acetoacet-para-chloroanilide
- Ethyl Acetoacetate
- Ethyl Benzoylacetate
- Ethyl Sodium Oxalacetate

FEED PRODUCTS
- Calcium Pantothenate (Feed Grade)
- Choline Chloride
- Curbay B-G* 80
- DL-Methionine (Feed Grade)
- Niacin, U.S.P.
- Riboflavin Concentrates
- Special Liquid Curbay*
- U.S.I. Vitamin B_{12} and Antibiotic Feed Supplements
- Vacutone* 40

OTHER PRODUCTS
- Acetaldehyde
- Caustic Soda
- Ethylene
- IPC (Isopropyl-N-Phenyl Carbamate)
- CIPC
- Liquid Chlorine
- Metallic Sodium
- Methionine (Pharm.)
- N-Acetyl DL-Methionine
- Nitrocellulose Solns.
- Propionaldehyde
- Propionic Acid
- Sulfuric Acid
- Urethan, U.S.P.

*Reg. U.S. Pat. Off.

U.S.I. INDUSTRIAL CHEMICALS CO.

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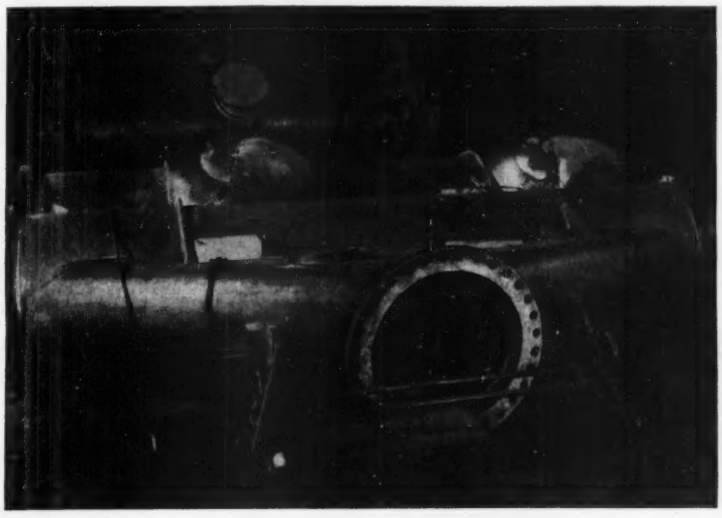
PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY APRIL-MAY 1954

3,360 Red Brass Tubes for This Condenser

Shown on one of Kellogg's boring mills (below) where the gasket face is being machined, this is a channel for one of four sections of a prefractionator condenser currently underway for a southwestern petroleum refinery.

Each bundle of the condenser will contain 840 tubes, ¾ inch in outside diameter by 16 feet in length. The water available for industrial purposes in the particular area where the condenser will be used is especially corrosive. To offset this, specifications call for red brass as the material for the tubes, this alloy having proved by experience to give the most effective protection against corrosion in the locality involved.



Tube sheets for the condenser will be of steel, clad with naval brass. Shell, shell cover, and channel are of steel. Design temperature is 200°F. on the shell side and 150°F. on the tube side.

Big Condenser Will Hold Pressure Drop to 5mm. Maximum

The drip-type condenser shown above in progress in Kellogg's shop has been designed to hold pressure drop on the shell side to the exceptionally low maximum of 5 mm. of mercury. Consisting of two sections, the unit will condense naphtha vapors and steam on the shell side and heat a petroleum distillate on the tube side. Operating pressure on the shell side will be 65 mm., and 150 psi. on the tube side.

Representative of one of the more complex types of exchanger units Kellogg is experienced in building, in addition to all the conventional types, this condenser is designed with an obround nozzle to spread the incoming vapors over the entire length of the tube bundle, thus providing for pure cross-flow heat transfer.

44,000-lb. Reactor for New Chemical Process

Similar in design to units refiners use in transforming certain petroleum gases into polymer gasoline, this big reactor (right) will shortly become an important part of a new chemical plant now building on the East Coast. The plant will be the first in this country to manufacture phenol from cumene, an intermediate material which in turn is obtained from benzene and propylene. This particular unit is the vessel in which the reaction to produce cumene will be carried out.

The tubular reactor is 3½ feet in internal diameter by 35½ feet in length, and is fabricated of high-tensile carbon steel, 1⅝ inches thick. When completed, it will tip the scales at some 44,000 pounds. The unit is designed for an internal pressure of 990 psi, and temperature of 510°F.

For further information, details of materials and services write

FABRICATED PRODUCTS DIVISION
THE
M. W. KELLOGG
COMPANY
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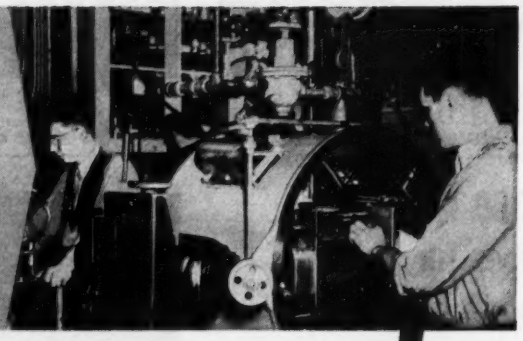

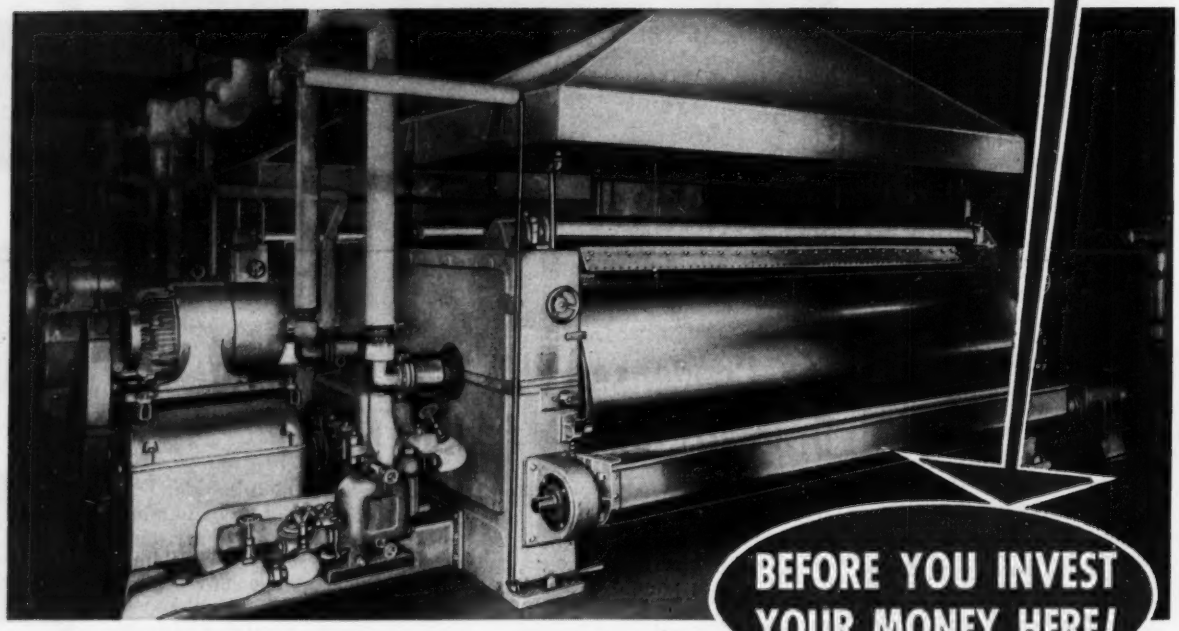

pre-testing shows the advantages of
BUFLOVAK DOUBLE DRUM DRYERS

Liquids converted directly to dry products by a continuous, low-cost process! That's the money-saving job that BUFLOVAK Double Drum Dryers are doing in hundreds of plants. New uses and products constantly are being found. Does a similar opportunity exist in your plant? The BUFLOVAK Research Laboratory will gladly help you find out. By pre-testing your product on a semi-plant scale recommendations are based on facts. You will get the exact type dryer that will cut costs . . . and make a better product. Frequently, new drying techniques are developed. There's a *best* type dryer for every purpose.

The full story of BUFLOVAK Processing Equipment reaches into many industries and products. There are all types of dryers, evaporators, kettles, and equipment for doing a better job in processing chemicals and foods. A request on your company letterhead will bring catalogs along with any information you may need.

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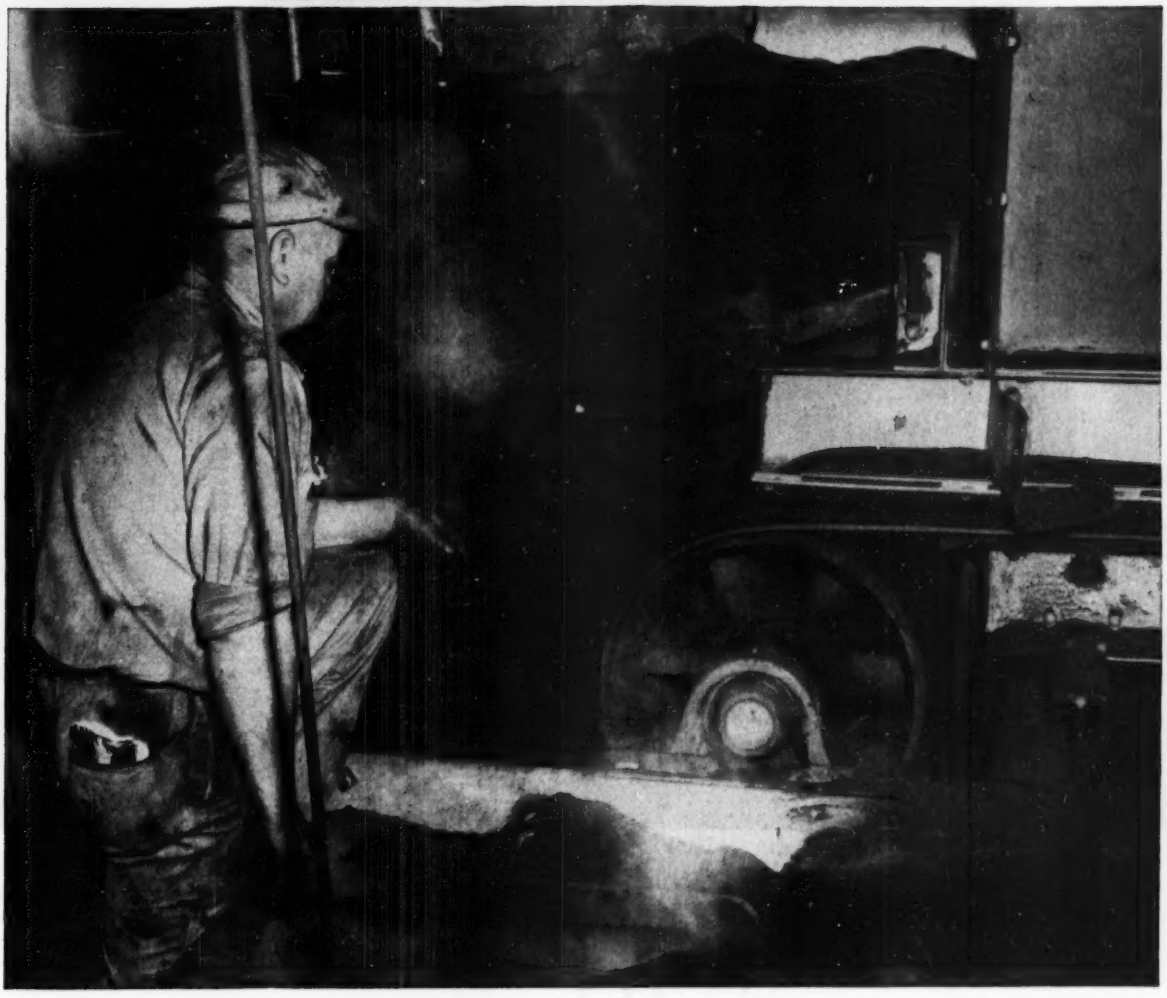
BUFLOVAK EQUIPMENT DIVISION

OF BLAW-KNOX COMPANY

1551 Fillmore Avenue • Buffalo 11, New York

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Where a B. F. Goodrich belt cut labor costs 90%

IT used to take a man an hour or two a day to clean up the mess around that conveyor belt. Sizzling hot sand, from casting molds, is dumped on the belt and carried to storage.

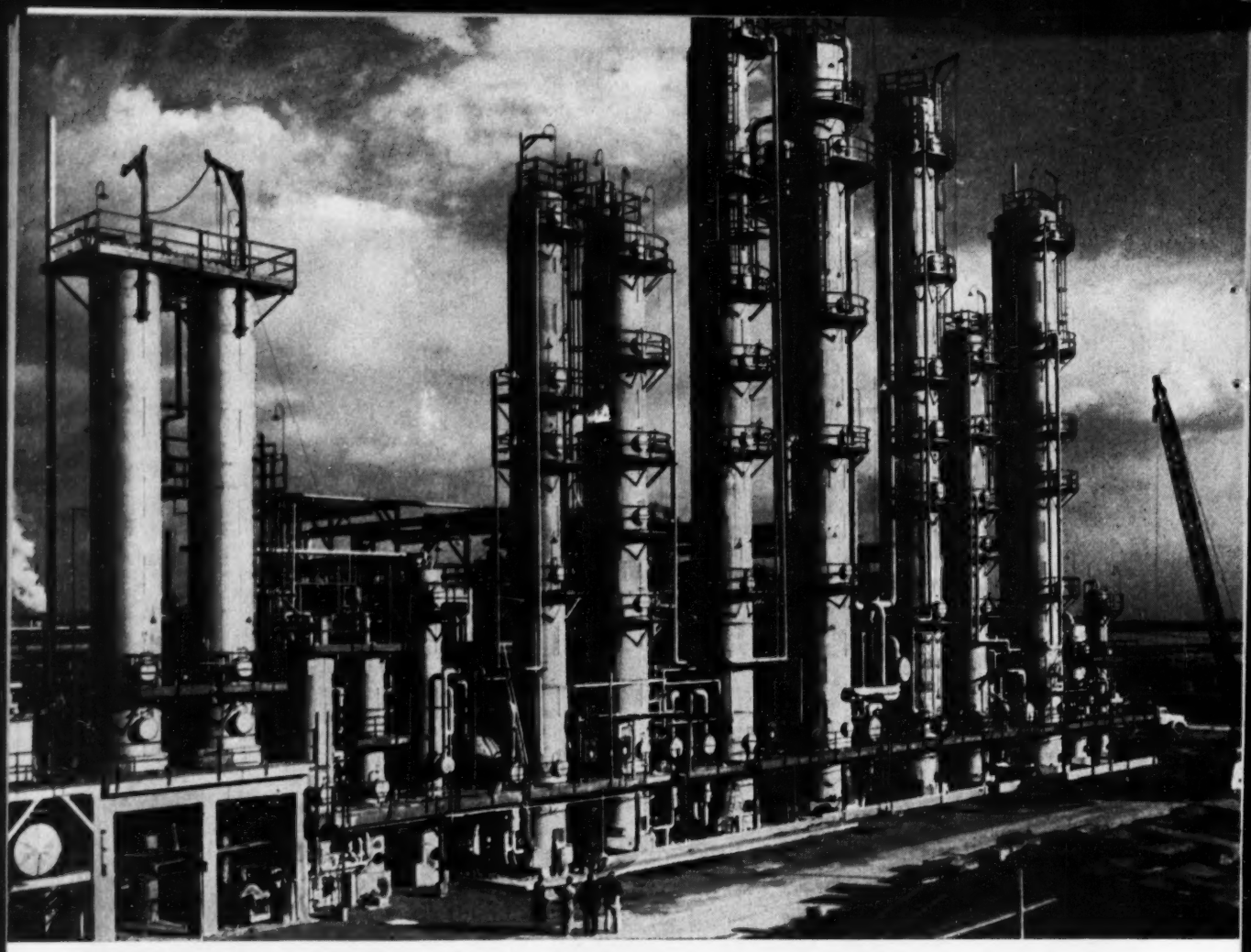
A woven-asbestos belt was used, but it had to have "first aid" every three weeks—a sticky dressing to protect it from the 300 degree heat. Then the steaming sand would cling to the belt cover. Some would build up on the return idlers, a great deal dropped on the floor. Clean-up time was costing the company $900 a year.

Then a B. F. Goodrich man told them his company had developed a special heat-resisting rubber for belts carrying such things as hot sand, lime, nitrates. Instead of ordinary fabric, B. F. Goodrich uses *glass* fabric to make a belt that can stand extreme heat.

The foundry installed this B. F. Goodrich belt. It runs 8 hours a day, 5 days a week, handles 75 tons an hour. Since it needs no liquid dressing, there's no sticking, no spillage. Clean-up time has been cut to once every 3 weeks.

Making a belt that stands terrific heat is typical of B. F. Goodrich product improvement. Other BFG improvements have resulted in Grommet V belts that last 20 to 50% longer, rubber linings which reduce the cost of handling acid and at the same time protect workers from injury—and hundreds of other products that last longer, serve better. To take full advantage of these many and frequent improvements, call in your BFG distributor or write *The B. F. Goodrich Company, Dept. M-231, Akron 18, Ohio.*

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION



SUN OIL'S PETROCHEMICAL PLANT

now making high-purity aromatics

NITRATION **BENZENE**

NITRATION **TOLUENE**

10 DEGREE **XYLENE**

The new $15 million Sun Oil Company petrochemical plant in Marcus Hook, Pa., can now supply benzene, toluene and xylene that meet a new high standard of purity. It is the largest and most modern plant on the East Coast producing these aromatics from petroleum.

Precision instrumentation, combined with the most modern available facilities, provides constant control of every step in the refining process. Only selected feed stocks are used. The result is month-in, month-out sameness—even with high volume throughput—plus new versatility and efficiency.

Other petrochemicals produced by Sun Oil Company include propylene trimer and tetramer, sulfonates, and a new type of high-molecular-weight naphthenic acid that is practically free of oil. For a technical bulletin describing any of these Sun petrochemicals, write Department CE-5

INDUSTRIAL PRODUCTS DEPARTMENT

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PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous Blue Sunoco Gasoline and Dynalube Motor Oils

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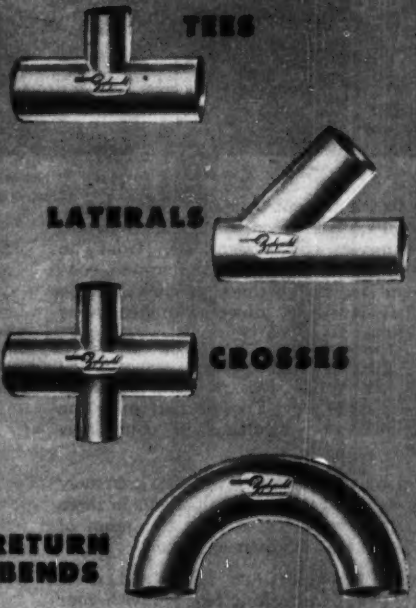
WELDING FITTINGS for CHEMICAL PROCESS Service



. . . Included in the Zephyrweld fittings line are reducers and adapters to permit their use with practically every other known type of fitting.

QUALITY *Stainless Steel Butt Welding Fittings in Schedule 5 — 10 — 40 and tube O. D. Sizes from ½" through 24" and 36"*

• TRI-CLOVER offers the most complete line of Zephyrweld Schedule 5 and 10 stainless steel welding fittings in sizes from ½" through 24" and 36" for use with stainless steel light gauge pipe and tubing. In addition, Schedule 40 fittings are available in sizes through 24".

These quality fittings are annealed, pickled and passivated in sizes through 4". Larger sizes are passivated and may be annealed upon request.

Employing modern, unique and proved methods throughout, these porosity-free fittings are fabricated from stainless steel types 304, 347, 316 and other stainless steel analyses.

Schedule 5 and 10 fitting ends are cut flush for rapid welding. Because of their light gauge, no chamfering is required. Schedule 40 fittings are beveled in accordance with ASA specifications. Fittings can be flame cut for disassembly, used again by re-welding.

See your nearest distributor for full details.

EXPORT DIVISION: 8 So. Michigan, Chicago, U. S. A.

PI-152R

WRITE FOR CATALOGS

Send for CATALOG 748, covering welding fittings for O.D. tubing—or for CATALOG 1051, covering Schedule 5-S and 10-S fittings for light gauge pipe.

Tri-Clover® MACHINE CO.
Kenosha, Wisconsin

TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

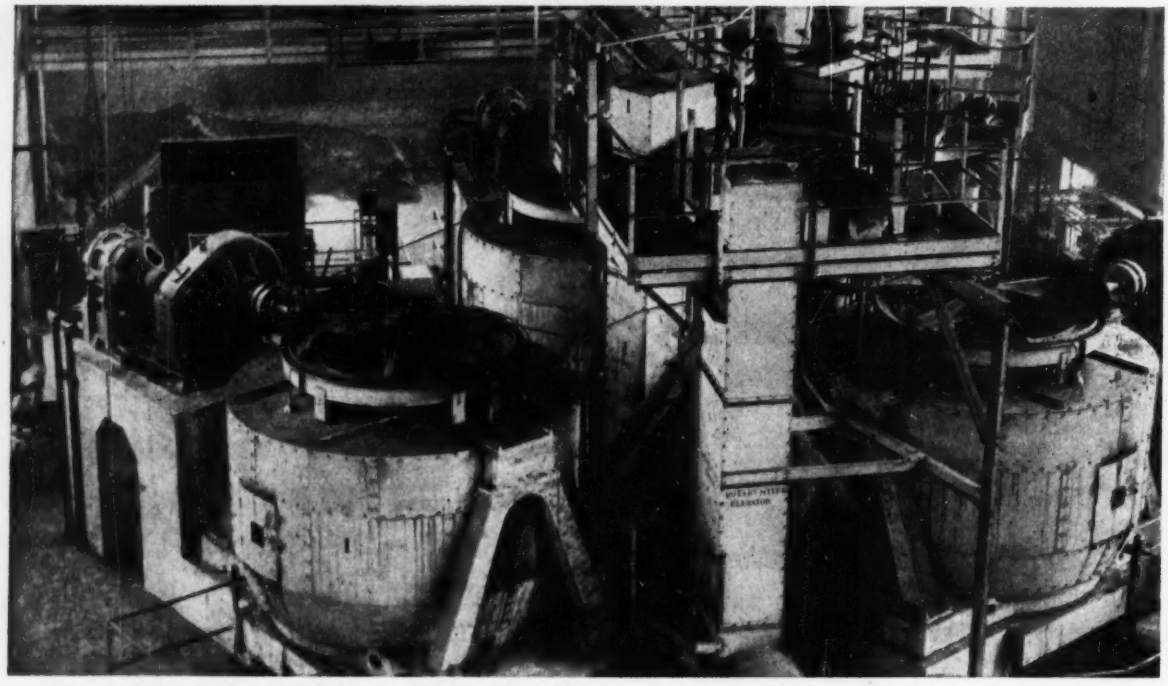
FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

THE Complete LINE

TIME-TESTED CHASERS

built for The New Jersey Zinc Co. (of Pa.)

Result in Improved Performance



Illustrated above are three 12' diameter chasers installed in a plant operated by The New Jersey Zinc Co. (of Pa.). They are used for the preparation of a mixture which is later briquetted.

Any information on items listed below will be sent to you immediately:

- Rotary Kilns, Coolers and Dryers
- Rotary Retorts, Calciners, Etc.
- Improved Vertical Lime Kilns
- Automatic Quick-Lime Hydrators
- Briquetting Equipment
- Open-Hearth Steel Castings
- Heavy Duty Electric Hoists
- Self-Contained Electric Hoists
- Cast-Steel Sheaves & Gears
- Diesel Locomotives
- Electric Locomotives
- Steel Plate Fabrications
- Hydraulic Presses

From 1919 to the present time, The New Jersey Zinc Co. (of Pa.) has procured fourteen chasers (i.e. mullers, mixers, edgerunners, etc.), from The Vulcan Iron Works. These chasers are in continuous operation, and because of their specific operation they have been subjected to great wear and severe shock.

Over these years there has been the closest cooperation between the engineering and operating staffs of The New Jersey Zinc Co. (of Pa.) and The Vulcan Iron Works, resulting in continuous improvement in the Chasers.

Because of their arduous tasks, they are extremely sturdy in design, and improvements made in them over the years have resulted in a minimum of maintenance, considering their operation.

The Vulcan Iron Works and its 105 years of experience is ready and willing to work with your engineering department to combat any problems that may arise. Write for detailed Bulletins or information today.

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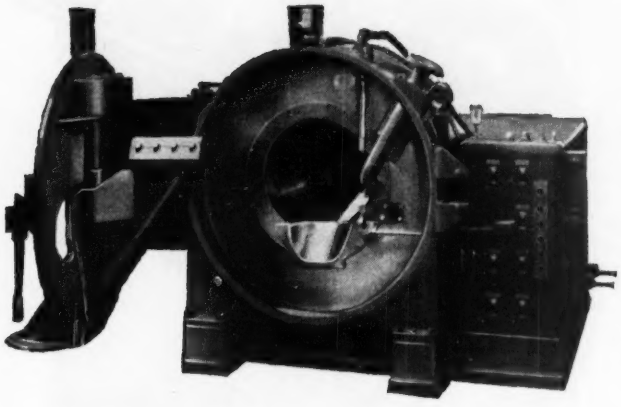
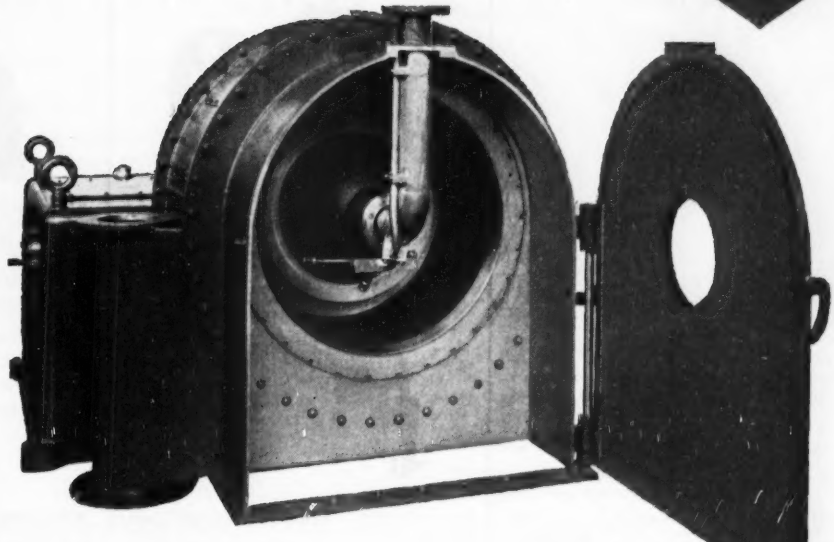


B-P Type HS Universal Filtering Centrifugal: Fully automatic, requires no operator attention, but can be equipped with manual controls. Simple, trouble-free cycle controller handles complicated centrifugation cycles easily — compensates for process variables. Easy change to almost any filter media keeps maintenance costs low. Constant speed drum rotation reduces power requirements. In capacities from laboratory sizes to 16,000 lbs. per hour.

B-P Type S Continuous Centrifugal: Continuous operation requires no timing or cycle controllers. No scrapers, baffles, rakes or plows to break down delicate crystals. Constant speed drum rotation keeps power requirements low. Rugged construction insures long service with very little maintenance. In capacities from laboratory sizes to 48,000 lbs. per hour.

Above: Type HS Universal Filtering Centrifugal for centrifugation of a wide range of filterable solid-liquid slurries.

Right: Type S Continuous Centrifugal for centrifugation of a wide range of relatively free-draining crystalline, granular and fibrous materials.



Write today for complete information.

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BAKER PERKINS INC.

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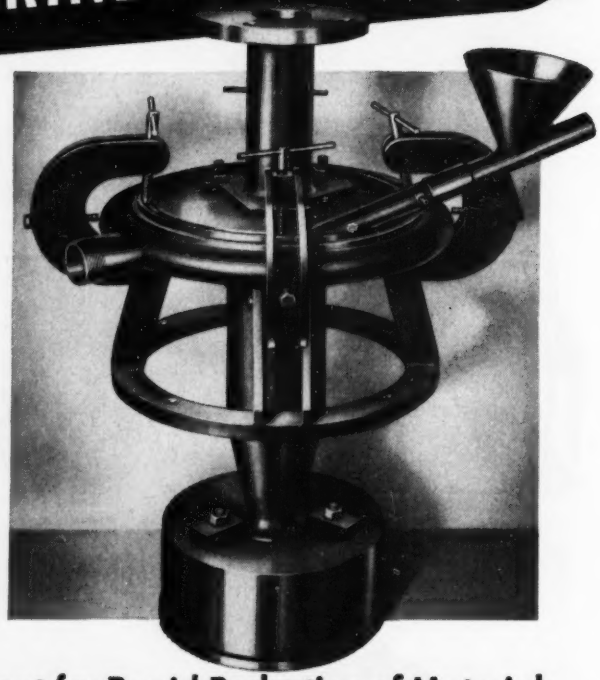
Sturtevant

MICRONIZER* GRINDING MACHINE



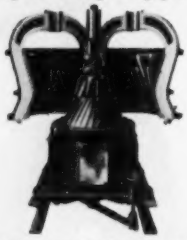
Reduces Solids to Micron Sizes

The new Sturtevant *Micronizer* grinding machine is a fluid jet grinder especially designed to reduce solid materials to particle sizes in the micron ranges.

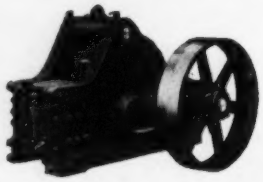
Sturtevant *Micronizers* are used for simultaneous dry grinding and classification of solids. The variety of materials that can be processed is large and includes both metallic and non-metallic minerals and ores, metals, pigments, insecticides, fungicides, pharmaceuticals, plastics, dyes and numerous other organic and inorganic products. Available in capacities from ½ to 3000 pounds per hour.

Other Sturtevant Pulverizing Equipment for Rapid Reduction of Materials...

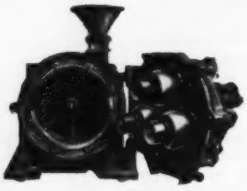
Especially Applicable for Initial Grinding of Products for the Micronizer Mill



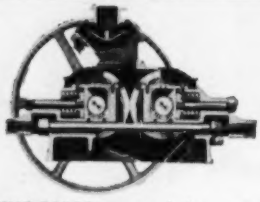
ROTARY FINE CRUSHERS for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



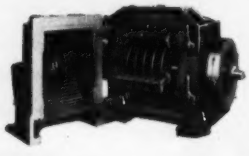
JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

AIR SEPARATOR for separation of fines to 325 mesh and finer. Increases output from 25% to 300%... lowers power costs by 50%. Capacities ¼ to 50 tons per hour output.

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DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS

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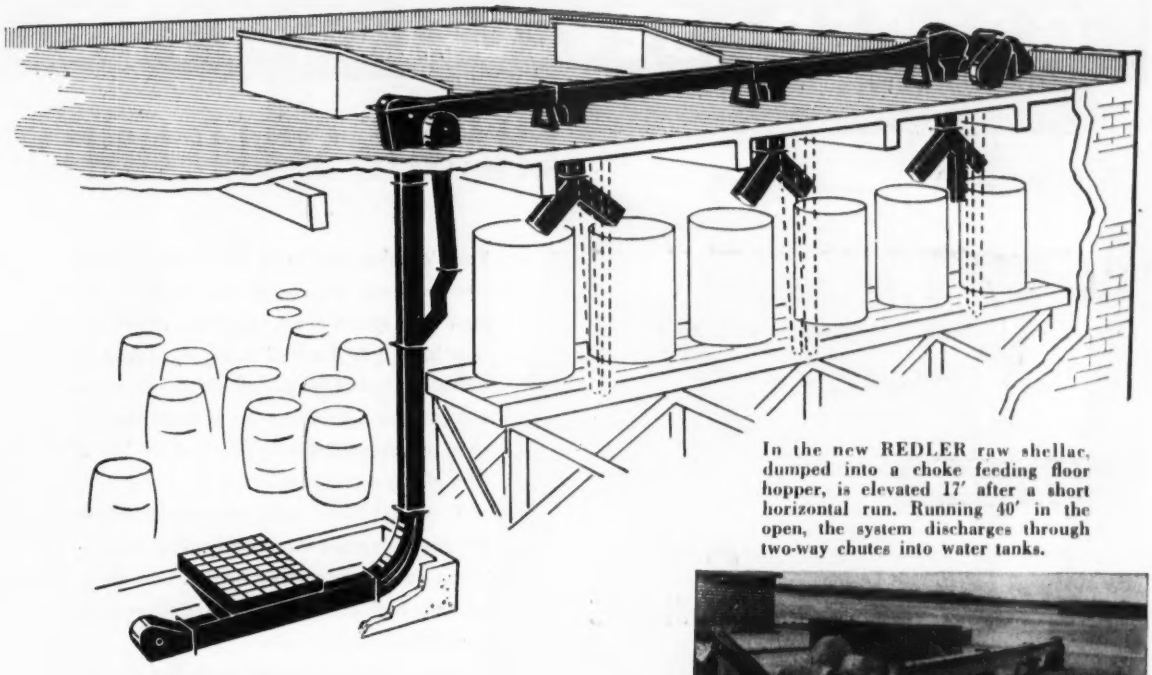


In the new REDLER raw shellac, dumped into a choke feeding floor hopper, is elevated 17′ after a short horizontal run. Running 40′ in the open, the system discharges through two-way chutes into water tanks.

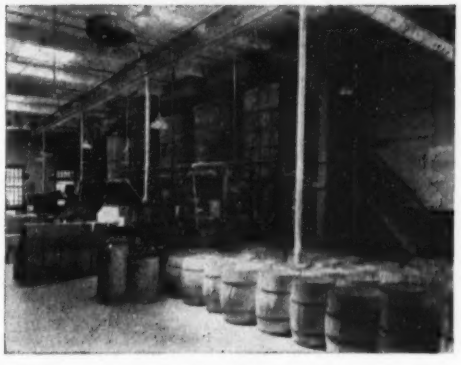
S-A REDLER

Conveying Systems for Shellac Cut Costs!

The S-A REDLER Conveying System you see above has a distinguished record to live up to. Back in 1940 the Parks Company of Somersett, Mass., bought their first REDLER to feed refined shellac to alcohol tanks. Savings in man-power, improvement in processing and cleanliness through 13 years led to the sale of this second REDLER for the handling of raw shellac.

Another advantage that pointed up the choice was REDLER'S ability to fit into small space with extremely low headroom and because it is fully enclosed to operate outdoors without shelter.

Second and third re-orders for REDLER Systems are common occurrences, justified by their performance wherever cleanliness and freedom from contamination are important. If you have a handling problem where these characteristics can help, mail the coupon below for our REDLER Bulletin. You'll find it fact-filled with ideas for better handling at lower cost.



This is the S-A REDLER System installed in 1940 to handle refined shellac. It operates entirely indoors, carrying the shellac over the alcohol tanks with extremely low headroom.

STEPHENS-ADAMSON MFG. CO.
40 Ridgeway Ave., Aurora, Ill., Los Angeles, Calif., Belleville, Ontario

Engineering Division	Specialists in the design and manufacture of all types of bulk materials conveying systems.
Standard Products Division	A complete line of conveyor accessories including centrifugal loaders—car pullers—bin level controls—etc.
SealMaster Division	A complete line of industrial ball bearing units available in both standard and special housings.

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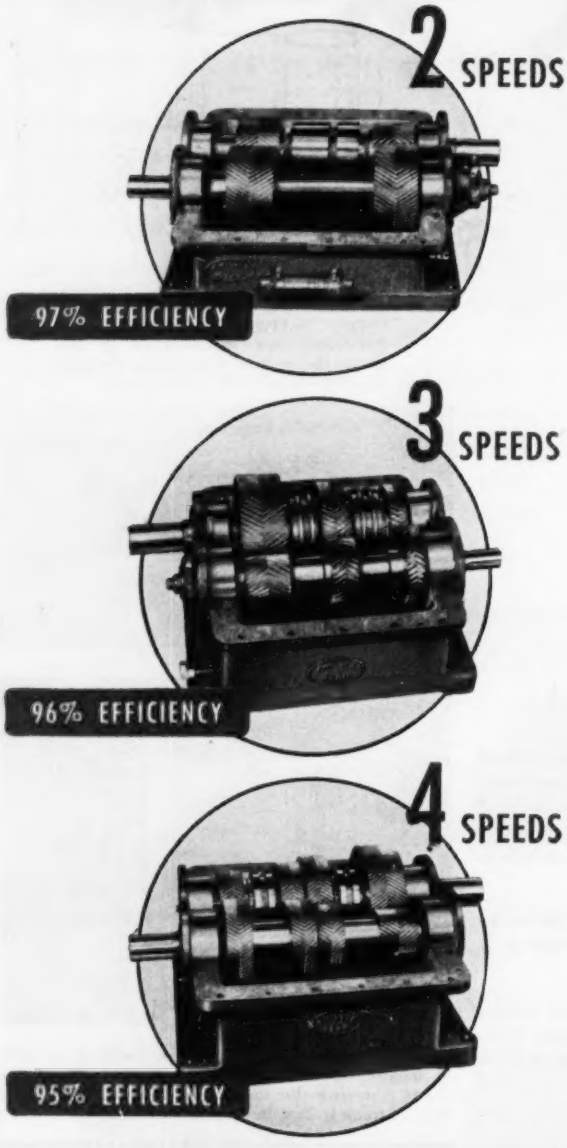
GEARED, SELECTIVE TYPE
CHANGE SPEED UNITS



Yes, "another first" with *Phillie Gear*, these *standardized*, self-contained, compact *all-gear type speed changers*. They are available in 2, 3 or 4 speed changes, providing definite ratios of speed reduction, speed increasing (or a combination of both). Speed changes are accomplished by just the "mere turn of a control lever".

These exclusive units were designed to fill Industry's need for a highly efficient, precision-built *standardized line* . . . to eliminate the high cost and delayed deliveries of specially designed units.

Gear specifications: All gears and pinions are Sykes Continuous Tooth Herringbone type, precision cut of involute shape, carefully heat treated and finished, and designed for maximum tooth contact and overlap.

All component parts and materials in these unusual Units are of highest quality and workmanship: Housings, Shafts, Bearings, Clutches, Lubrication Systems, etc.

Ratings are according to AGMA recommendations for continuous service, with allowance for 100% overload in starting and for momentary shock loads . . . shafts and bearings are of proper size to permit heavy overhung loads resulting from use of sprockets or pulleys.

Be convinced, write for 24 page illustrated catalog #CSU-52.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

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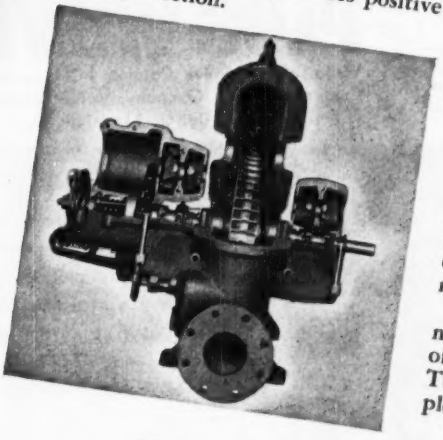
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

TERRY

PROTECTION OF TURBINE BLADES made possible by nozzle location

The Terry Solid-wheel Turbine is of the impulse, helical flow type. The steam issues from an expanding nozzle at high velocity and enters the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is returned to the wheel several times until practically all of the energy has been utilized. This principle makes possible the efficient use of steam in a single-piece, almost indestructible wheel.

In the Terry Solid-wheel Turbine, the steam enters the buckets in a direction at right angles to the shaft, as shown above. This design eliminates the need for close clearances and provides positive blade protection.



The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, projecting rims on each side of the buckets prevent damage to the blades even though external thrust should move the wheel.

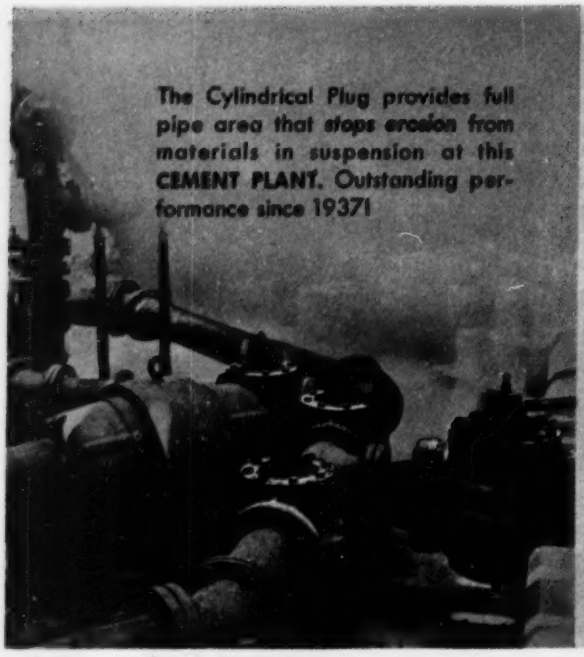
This is only one of the many important features of the Terry Solid-wheel Turbine. Write for complete details.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1195

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.



The Cylindrical Plug provides full pipe area that *stops erosion* from materials in suspension at this **CEMENT PLANT.** Outstanding performance since 1937!

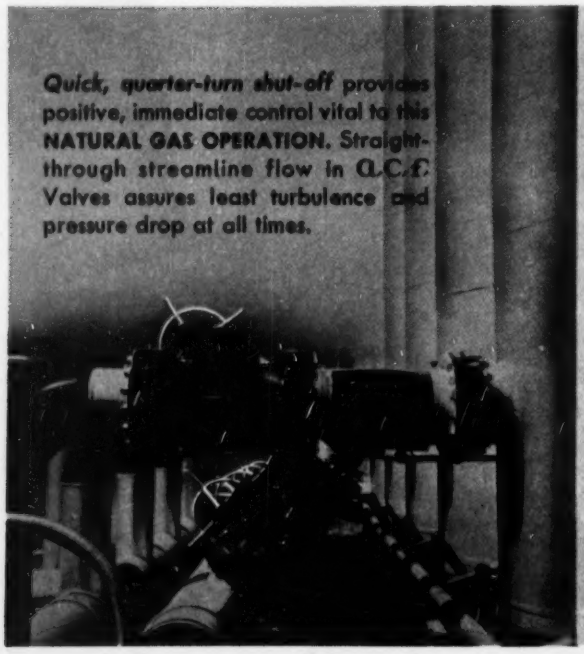
In **SEWAGE PLANTS,** a.c.f. Cylindrical Plug shears obstructions on raw sewage and sludge lines or, as here, controls gas for heat booster on digestor circulating water.

PROOF OF SUPERIORITY

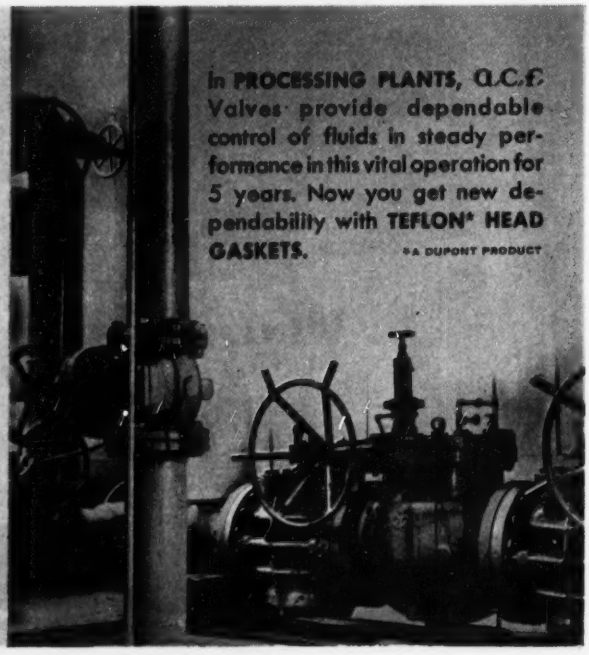
a.c.f. CYLINDRICAL FULL PIPE AREA **PLUG VALVES**

Representatives in 50 Principal Cities

Write for descriptive Catalog 4-CM to American Car and Foundry Company, Valve Division, 1501 E. Ferry Avenue, Detroit 11, Michigan.



Quick, quarter-turn shut-off provides positive, immediate control vital to this **NATURAL GAS OPERATION.** Straight-through streamline flow in a.c.f. Valves assures least turbulence and pressure drop at all times.



In **PROCESSING PLANTS,** a.c.f. Valves provide dependable control of fluids in steady performance in this vital operation for 5 years. Now you get new dependability with **TEFLON* HEAD GASKETS.**

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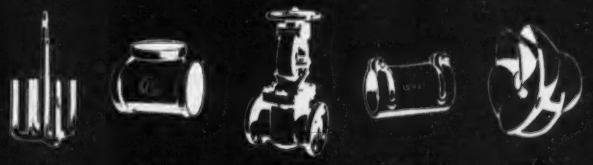
COOPER ALLOY PRODUCTS

... AND Relax

You'll sleep like a baby once you've put your corrosion problems in our hands. Whether you want that specially engineered part to be just right—or need top quality cast stainless components in large quantities—or are looking for reliable stainless steel valves, fittings and accessories, specify Cooper Alloy, and stop worrying. One thing is sure—our reputation was built on quality. Use our products with confidence and relax.



mixer fitting valve Quikup! impeller

COOPER ALLOY

THE COOPER ALLOY FOUNDRY CO. • HILLSIDE, N. J.

Los Angeles San Francisco Oakland Houston Chicago Detroit Philadelphia Hartford

Leading producers of STAINLESS STEEL valves, fittings and castings

THE BIGGEST, SINGLE-PIECE MOLDED TANKS IN THE WORLD!

The tanks were big and good. At the factory our workers said "That's the biggest and best shipment of Haveg we ever made." Each tank holds 7500 gallons and is 10′ in diameter, 14′ high. By all standards they are the world's largest one-piece seamless plastic moldings ever made.

Our customer is one of the world's largest and best-known chemical manufacturers. On our books since Haveg was introduced 20 years ago, they know from experience that Haveg is the best construction material for permanent resistance to corrosion for their processes.

Whatever the service, Haveg lasts and lasts and lasts. It is not a coating, not a lining. It gives resistance to corrosion through and through, never allowing corrosives an opening wedge from cracks.

Deliveries are good. Tanks, two to four weeks. Pipe, from stock. Towers, two to eight weeks. Fume duct, two weeks.

If you are tired of worrying about the cost and effects of corrosion in your processing, try Haveg. If you want an installation that reduces contamination of your product, try Haveg. If you want big, small, standard or special equipment molded exactly to your specifications, try Haveg.

Call your nearest Haveg sales office. Write for big 64-page Bulletin that tells all about Haveg corrosion-resistant equipment for the process industries.

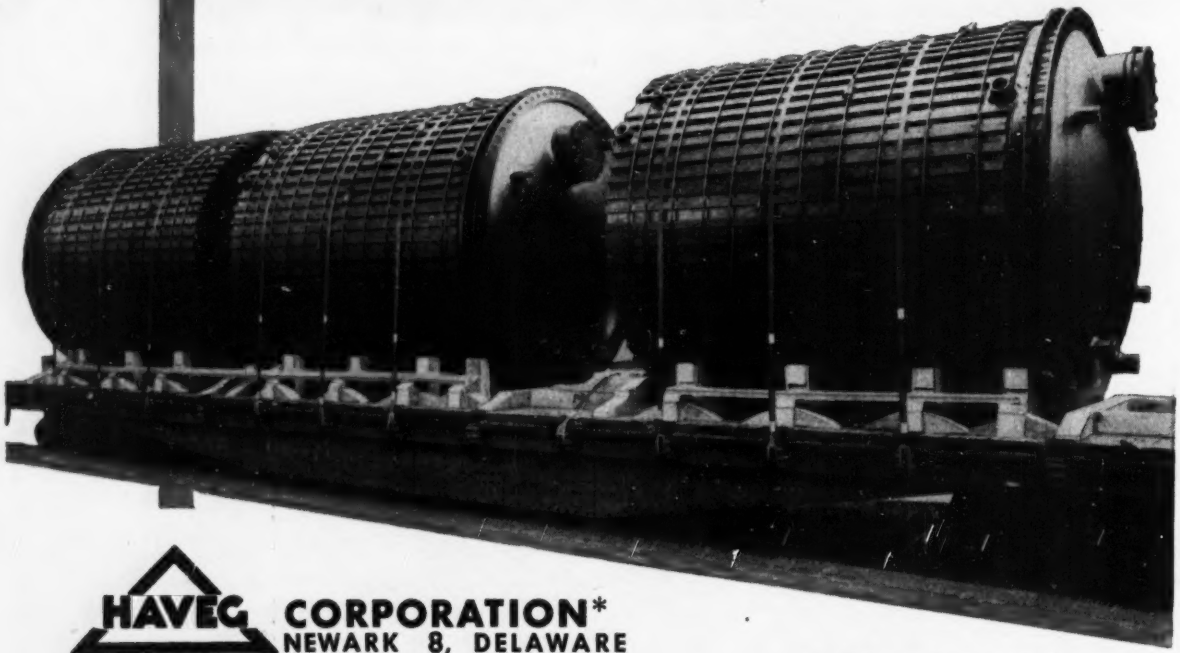
PUMPS

VALVES

PIPE

DUCT

HEAT EXCHANGERS



HAVEG CORPORATION*
NEWARK 8, DELAWARE
TRADE MARK REG. U. S. PAT. OFF.
FACTORY: MARSHALLTON, DEL. • Wilmington 3-8884

*A subsidiary of Continental-Diamond Fibre Co.

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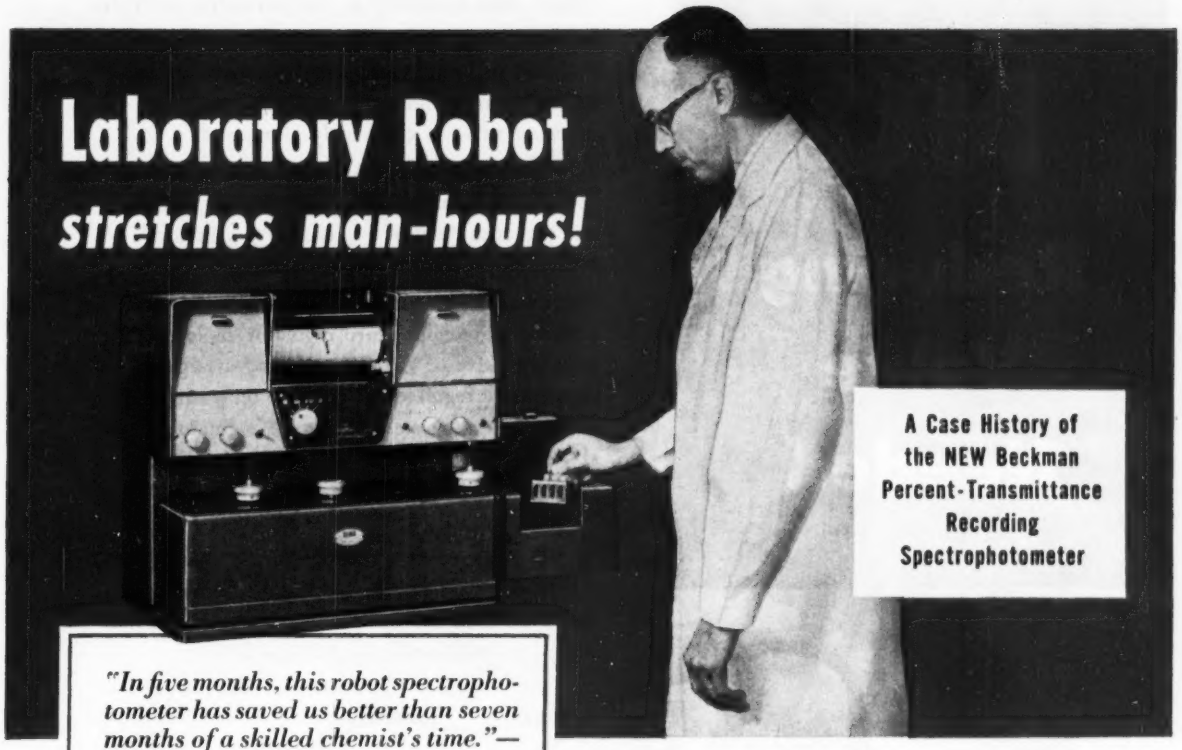
CLEVELAND 20, Washington 1-8700 • DETROIT 35, Broadway 3-0880 • HARTFORD 5, Hartford 6-4250
HOUSTON 4, Jackson 6840 • LOS ANGELES 14, Mutual 1105 • SEATTLE 7, Hemlock 1351 • ST. LOUIS 17, Hiland 1223

Laboratory Robot *stretches man-hours!*



A Case History of the NEW Beckman Percent-Transmittance Recording Spectrophotometer

"In five months, this robot spectrophotometer has saved us better than seven months of a skilled chemist's time."—

A leading independent laboratory, Truesdail Laboratories, Inc. of Los Angeles, has used a Beckman Model DR Recording Spectrophotometer in from 30 to 40 percent of all its testing and research work. Read what Dr. Truesdail and his staff have to say about this revolutionary, time-saving apparatus.

Among its many assignments, the Beckman Recording Spectrophotometer is used at Truesdail Laboratories in the examination of alkaloids, synthetics, drugs in human and animal body fluids, foreign constituents in drugs, heavy metals in plastics, caffein in coffees, theobromine in cocoa, and scores of others.

For more information on this remarkable analytical robot, write for Data File 96–14

Automatic percent-transmittance recording with the famous Beckman Model DU Quartz Monochromator.

"Complete spectra recorded with this instrument offer a major advantage. Where formerly we ran just a few points on a curve — possibly missing important data — we now obtain a full, neatly-printed spectrum on easy-to-file notebook paper."

Runs three samples simultaneously, at speeds exceeding the fastest manual plotting.

"The Beckman Recording Spectrophotometer has put spectrochemical analysis on a mass production basis. In use five or six hours a day, its speed saves us more than the time of one chemist. The "three sample" feature enables direct Beer's Law, pH or other comparisons on the same chart."

Carefully designed to preserve the high inherent accuracy of the single-beam Model DU Spectrophotometer.

"If anything, the accuracy of this robot instrument surpasses that of our most skilled manual operators. We find it much easier to obtain maximum sensitivity through automatic operation than is possible manually."

Beckman *division*

BECKMAN INSTRUMENTS, INC.
SOUTH PASADENA 1, CALIFORNIA

NO Reducing Valve Needed

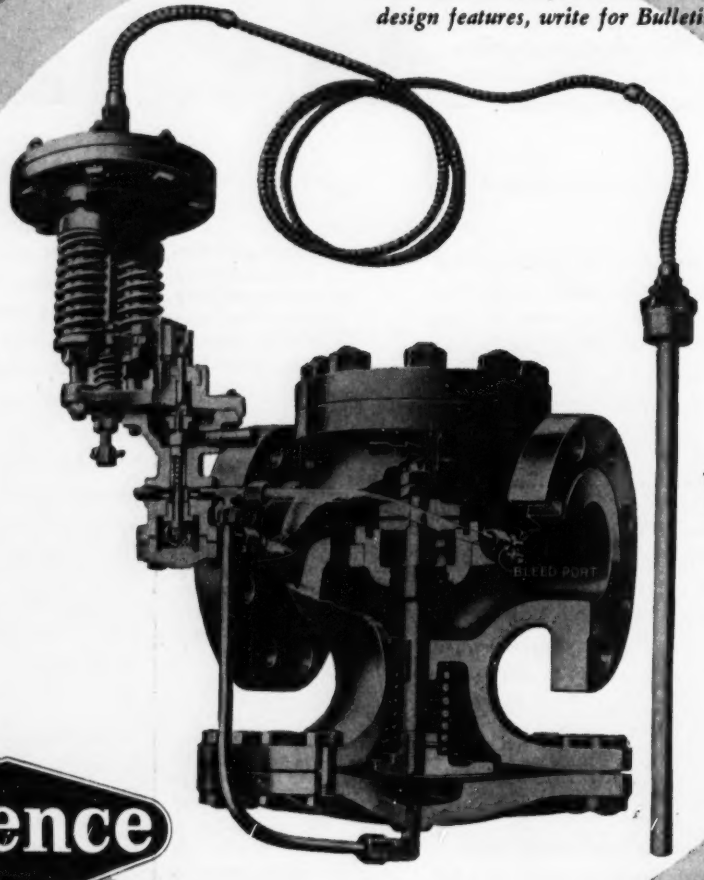
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



SPENCE
TYPE ET150
Temperature
Regulator

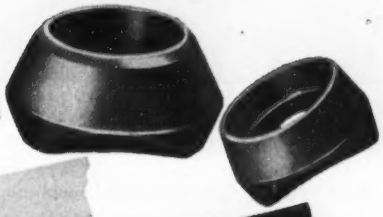
Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

65-139

FROM THE HORN OF PLENTY AT BONNEY FORGE

WELDOLETS and THREDOLETS for Stainless and Alloy Piping



STAINLESS
F 304 304 ELC F 316 F 347

CHROME MOLY
A 182 F 12 F 11 F 22 F 5

MONEL

WROUGHT IRON

ALUMINUM

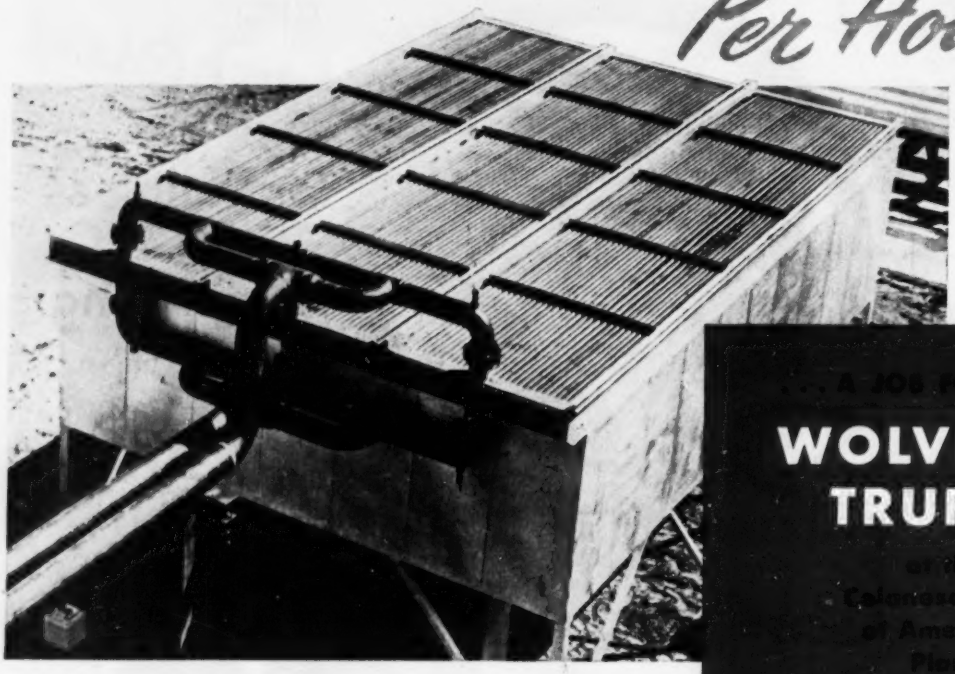
AND OTHER ALLOYS

When constructing with alloy, you're investing *real money*. Assure performance-proved fittings and save dollars by specifying and using Weldolets and Thredolets for 90° branch joints—large and small, full size and reducing.

Distributors in Principal Cities

WELDING FITTINGS DIVISION
BONNEY FORGE & TOOL WORKS
ENG. DEPT., 732 MEADOW STREET
ALLENTOWN, PENNSYLVANIA

"Get Rid of 229,400,000 BTUs Per Hour!"



. . . A JOB FOR

WOLVERINE TRUFIN*

at the Celanese Corp. of America's Plant

"Get rid of 229,400,000 BTUs per hour!"

That's the size of the job tackled by 26 Alco "Aircoolers" in the Celanese Corporation of America's plant at Pampa, Texas. Vital to the success of the installation is the role played by Wolverine Trufin Type L/C—*the bi-metal integral-finned tube.*

In this application, the integral-finned aluminum tubing resists corrosion of sour gas contained in the atmosphere. At the same time, a stainless steel liner retards the corrosive action of acetic acid, methyl and ethyl acetate. The two metals are in tight mechanical bond, which provides a maximum rate of heat transfer over a long period.

The ability of Trufin to stand up under varying temperatures, vibrations and pressures is just one of the reasons for its selection in this installation.

About 220,000 lineal feet of stainless steel and 110,000 pounds of aluminum tubing comprise this Trufin installation. The 26 cooler units possess a total of 57 tube bundles—any of which can be removed by simply sliding them out of their stainless steel channel frames.

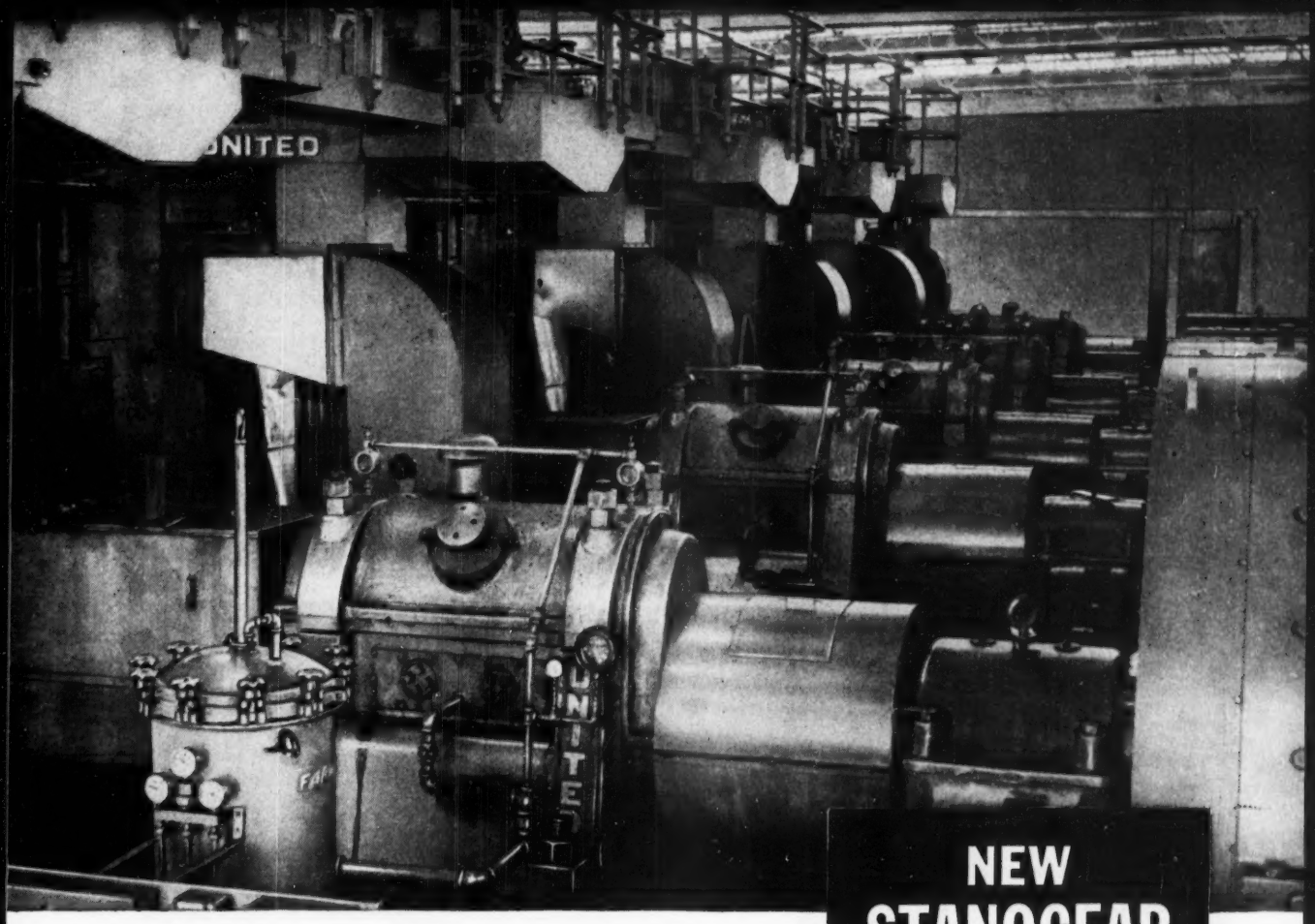
Trufin can help you, too: Yes, Wolverine Trufin—of bi-metal, copper, copper-base alloys, aluminum, electric-welded or stainless steel—can do a job for you, too! You'll find all the information you need in Wolverine's new condenser tube booklet. Write for your copy—today! WOLVERINE TUBE DIVISION of Calumet & Hecla, Inc., 1443 Central Avenue, Detroit 9, Michigan.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

*REG. U.S. PAT. OFF.

WOLVERINE TUBE DIVISION
OF CALUMET & HECLA, INC
Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES
EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK.



NEW STANOGEAR REG. U. S. PAT. OFF. **Compounds**

NOW . . . 7 ways better for extreme-pressure lubrication . . .

New and improved STANOGEAR Compounds have been developed to meet the requirements of an increasing variety of tougher extreme-pressure lubricating jobs found throughout industry, today. The result of several years of special research and field test work, these outstanding products have proved in actual service their ability to provide these important advantages:

1. Higher load carrying capacity. Use of improved extreme-pressure additives in STANOGEAR Compounds provide a greater anti-weld property. This results in the higher load carrying capacity which these products have demonstrated in actual service.

2. Superior retention of load carrying capacity. In service tests, STANOGEAR Compounds have proved superior to conventional extreme-pressure lubricants in ability to maintain a high load carrying capacity over extended periods of service.

3. Freedom from objectionable deposits. Appropriate base stocks and additives give STANOGEAR Compounds a high resistance to oxidation, thus minimize the formation of deposits.

4. Excellent storage stability. STANOGEAR Compounds contain compounding ingredients which assure excellent stability both in service and storage.

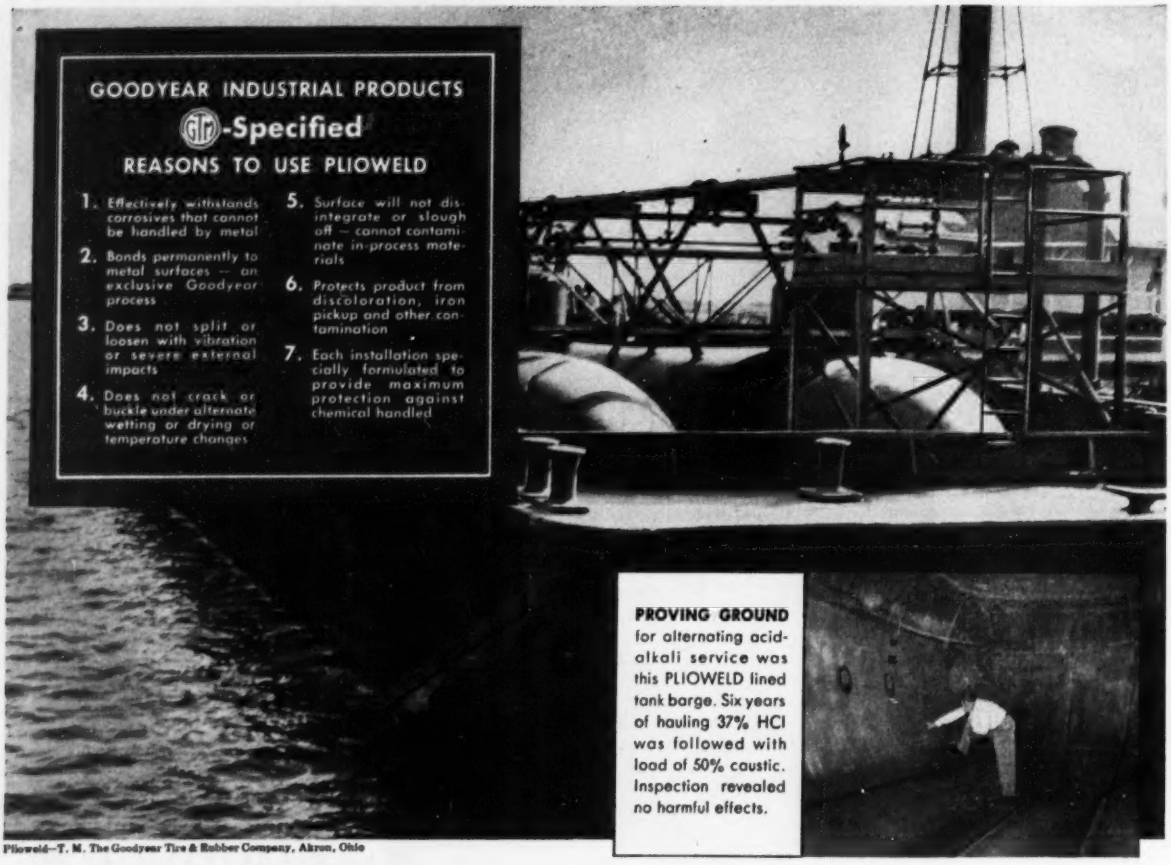
5. Good water separation. STANOGEAR Compounds have demonstrated their superiority to ordinary extreme-pressure lubricants in ability to provide good water separation.

6. Anti-foaming. Under adverse operating conditions, the anti-foam agent in STANOGEAR Compounds has prevented foaming troubles.

7. Versatility. A unique combination of additives in STANOGEAR Compounds equips these products for various industrial gear applications where extreme-pressure lubricating properties are necessary. To meet varying viscosity requirements, STANOGEAR Compounds are available in eight viscosity grades.

The Standard lubrication specialist in your area of the Midwest will be glad to give you more information about the new STANOGEAR Compounds. You need only phone your local Standard Oil office. Or write: Standard Oil Co., 910 South Michigan Avenue, Chicago 80, Illinois

STANDARD OIL COMPANY STANDARD *(Indiana)*


GOODYEAR INDUSTRIAL PRODUCTS
GT-Specified
REASONS TO USE PLIOWELD
1. Effectively withstands corrosives that cannot be handled by metal
2. Bonds permanently to metal surfaces — an exclusive Goodyear process
3. Does not split or loosen with vibration or severe external impacts
4. Does not crack or buckle under alternate wetting or drying or temperature changes
5. Surface will not disintegrate or slough off — cannot contaminate in-process materials
6. Protects product from discoloration, iron pickup and other contamination
7. Each installation specially formulated to provide maximum protection against chemical handled
PROVING GROUND for alternating acid-alkali service was this PLIOWELD lined tank barge. Six years of hauling 37% HCl was followed with load of 50% caustic. Inspection revealed no harmful effects.

Plioweld—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

ALTERNATING ACID-ALKALI SERVICE

now proved practical with PLIOWELD

THE possibility of alternately shipping acids and alkalies in rubber-lined equipment has long interested both supplier and user. Substantial savings were in the offing, but so were costly consequences. It remained for the G.T.M.—Goodyear Technical Man—to prove such shipments were entirely practical.

He started in the laboratory. Samples of PLIOWELD—custom compounded rubber lining—were alternately immersed in 37% hydrochloric acid and 50% caustic soda. The result—"After 3½ years of interchange it was evident that no apparent damage had occurred to the exposed samples."

Next came a full-scale field trial. A tank barge with six years' service hauling 37% HCl was selected. Following the test load of 50% caustic, came this report—"Our findings were that the rubber was in excellent shape—no blisters, separations or any evident change."

PLIOWELD does many jobs well. Whenever corrosion or abrasion threatens your equipment, see the G.T.M. about this proved-better protection. Or write Goodyear, Industrial Products Division, Akron 16, Ohio.

YOUR GOODYEAR DISTRIBUTOR *can quickly supply you with Hose, Flat Belts, V-Belts, Packing or Rolls. Look for him in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods."*

GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

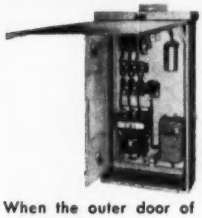
In the petroleum industry . . .

It pays to install trouble free

Allen-Bradley Motor Control

Pump Control Panels Provide for Complete Protection against the Weather

Bulletin 712X Pump Control Panels can be set to a predetermined time schedule. All pump control panels are mounted in an enclosure suitable for outdoor installation.



When the outer door of the enclosure is opened, only the lightning arrester and time clock are exposed. A second door (open here) covers the starting switch, fuses, and disconnect switch.

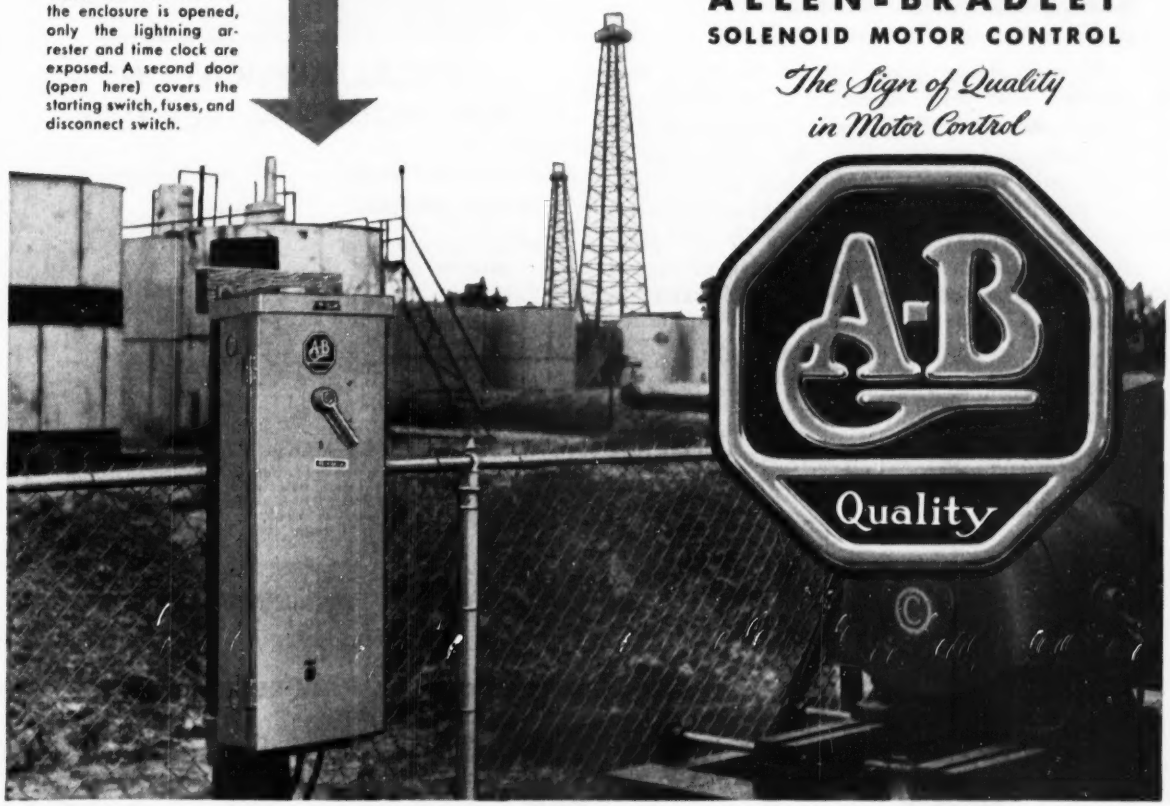
Over the years, Allen-Bradley solenoid starters have established their reputation for being dependable and trouble free. Only ONE moving part—the absolute minimum of moving and wearing parts—guarantees millions of trouble free operations. Also, the double break, silver alloy contacts require no maintenance. These are important assets in starters in remote locations far removed from routine inspection.

Incidentally, you can always find the right relay or starter enclosure in the Allen-Bradley line that will afford the maximum protection to your plant, personnel, and production schedules.

Really, you can't go wrong when you add "Allen-Bradley" to your motor control specifications. See the nearest Allen-Bradley control engineer for his recommendations.

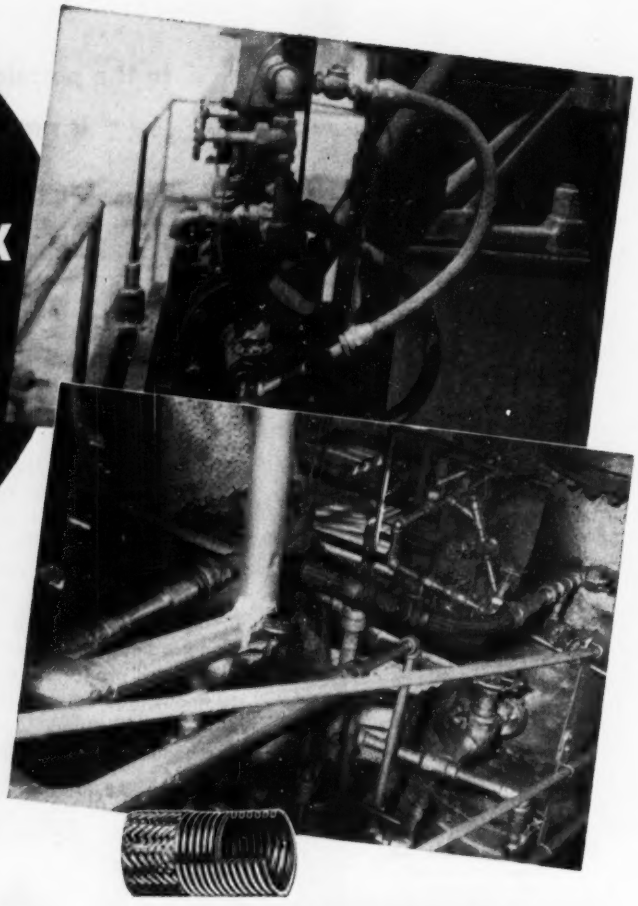
Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wis.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
The Sign of Quality in Motor Control



Allen-Bradley Pump Control Panel on pumping unit operated by the Honkamer Investment Co., Baytown, Texas.

NOW
INDUSTRIAL REX-FLEX
Heavy Wall
Stainless Steel
HOSE



Available in four types to meet every industrial need

TYPE RF-44—Annularly corrugated; sizes from 2½" through 6" I.D. for working pressures to 40 psi.

TYPE RF-45—Same as Type RF-44, but with metal braid covering for working pressures to 410 psi.

TYPE RF-54—Helically corrugated; sizes from ¼" through 2", I.D. for working pressures to 440 psi.

TYPE RF-55—Same as Type RF-54, but with metal braid covering for working pressures to 3100 psi.

To meet the growing demand for heavy duty stainless steel hose, Flexonics Corporation now offers new heavy wall Industrial REX-FLEX. Backed by unmatched experience in the manufacture of corrugated stainless steel, steel and bronze hose, the new Industrial REX-FLEX marks an important step forward in the development of corrosion-resistant hose that can stand the gaff of rugged industrial service, and still maintain maximum flexibility.

A complete range of flanged or screwed fittings may be used, attachment being made by silver brazing or atomic hydrogen welding.

See your industrial distributor, or write for data sheets giving full specifications on Industrial REX-FLEX.

TYPICAL APPLICATIONS FOR INDUSTRIAL REX-FLEX

- *Weigh tank connections*
- *Superheated steam*
- *Conveying corrosive gases and liquids*
- *High temperature connections*
- *Vibration connections*
- *Vacuum hose*
- *Fireproof connections*
- *Conduit*
- *Offset motions*
- *Continuous flexations*
- *Air ducts*
- *Exhaust connections, etc.*

WRITE FOR CATALOG

Industrial REX-FLEX is part of Flexonics' complete line of flexible metal hose. All types are described in Catalog 130-R. Or see the Flexonics' catalogs in Sweets, Chemical Engineering Catalog or Refinery Catalog.

Flexonics *Corporation*

CHICAGO METAL HOSE DIVISION

1317 S. THIRD AVENUE • MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

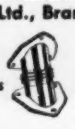
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 52 years.

Flexible metal hose

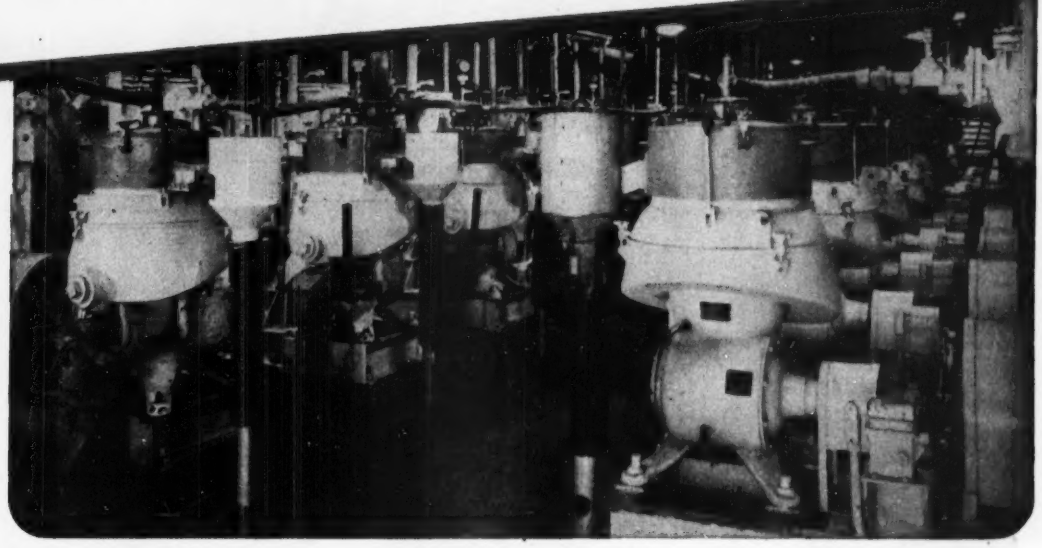
Expansion joints

Aircraft components



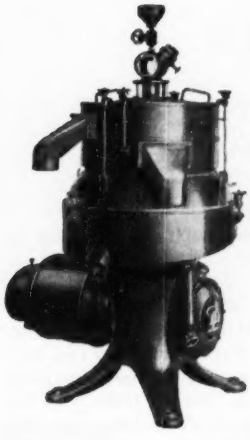
Metallic bellows

DE LAVAL CENTRIFUGALS EFFECTIVELY CONCENTRATE SLURRIES...



...These Are Dewatering Gluten

What Is Your Problem?



The concentration of gluten is very effectively done by means of De Laval Separators. Many slurries, in fact, respond to the separating action of centrifugal force when filters or gravity produce little or no effect. Moreover, the successful centrifuging of a mixture automatically means time saved, for the action of centrifugal force is continuous. Gluten is only one more example of a substance that can be thickened both quicker and better centrifugally.

In the past forty odd years, De Laval engineers have solved hundreds of separating and concentrating problems. Many such problems have been in a field where the machines have continued to operate successfully for years. Some have been tests made in the laboratory only—but these tests too, are valuable, for the products involved may closely resemble the product that *you* wish to separate, concentrate or clarify.

It may pay you well to consult a De Laval engineer. You may be able to put the collective knowledge of The De Laval Separator Company, which is available to you through him, to work for you.

THE DE LAVAL SEPARATOR COMPANY

Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL FOR FASTER PROCESSING SYSTEMS

Relief... for a production pain

What's your particular "ache"? Looking for ways to cut costs... improve production... speed plant operations... reduce maintenance costs?

Here's a prescription that can provide an effective solution for you... the specialized service offered by your Chain Belt Field Sales Engineer and the outstanding performance of Chain Belt Equipment:

for example: If bucket elevator chain breakage is your "headache," Rex® S-858 and S-856 chains will provide relief. These precision-made steel chains will not break... properly applied, they may *wear* out after the longest possible service life. They will outlast... outwear any other chains built for bucket elevator service.

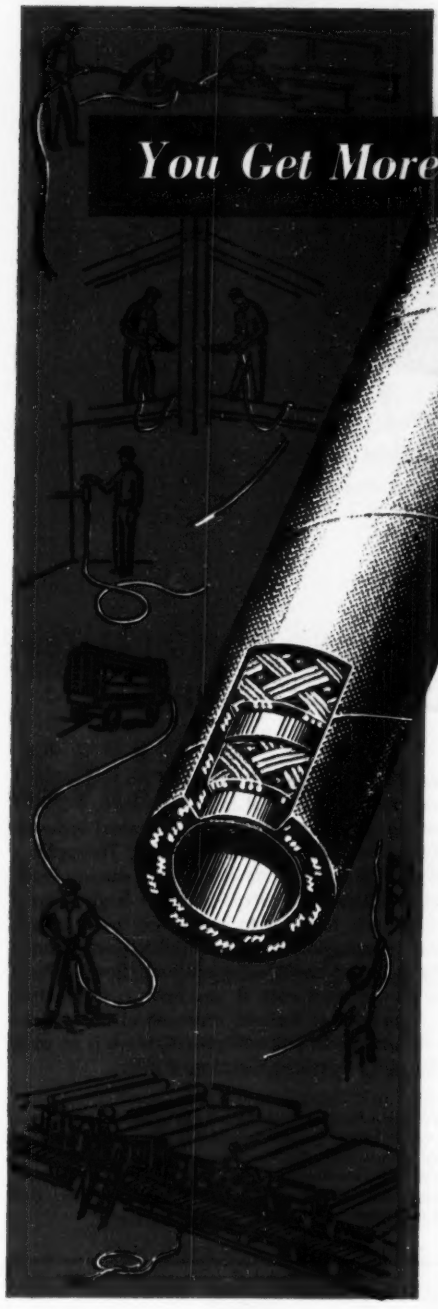
for example: If you're having trouble with your chain drives, Rex Chabelco® Steel Chains are your answer. These rugged chains are designed and built for the toughest service, especially where dust, dirt or heat is a problem. They stand up under heaviest loads... transmit more h.p. per dollar.

for example: If maintenance is your problem, here's a suggestion. Use Rex Split Hardened Rim Traction Wheels and Sprockets. Just install the body, then each rim segment. Replacement of rim section can be done without removing the chain. Down time can be reduced with these long-wearing traction wheels and sprockets.

Whatever your needs... drive chain, conveyor and elevator chain, complete elevators, belt conveyors, feeders, roller bearings, buckets or sprockets, you'll relieve those production pains by looking to Chain Belt. See your local Field Sales Engineer or write direct to Chain Belt Company, 4648 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY

District Sales Offices and Distributors in all Principal Cities



You Get More Use per Dollar with Homoflex Hose

For air, water, other fluids and gases Homoflex Hose is
easier to handle because it has no pre-set twist,
coils and uncoils easily with no kinking,
is light in weight, yet strong, and
"Flexible as a Rope."

R/M Hose Engineering makes possible high flexibility . . .
homogeneous cover, strength member and tube
that are inseparable.

Homoflex Hose gives you
"More Use per Dollar" two ways . . .
men do more work with it . . .
and it lasts longer.

Ask the R/M Distributor for Bulletin 6879 . . .
and, don't forget, there's equally good
"More Use per Dollar" engineering in
All other types of R/M hose, conveyor belts,
V-belts and flat transmission belts.

RM

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

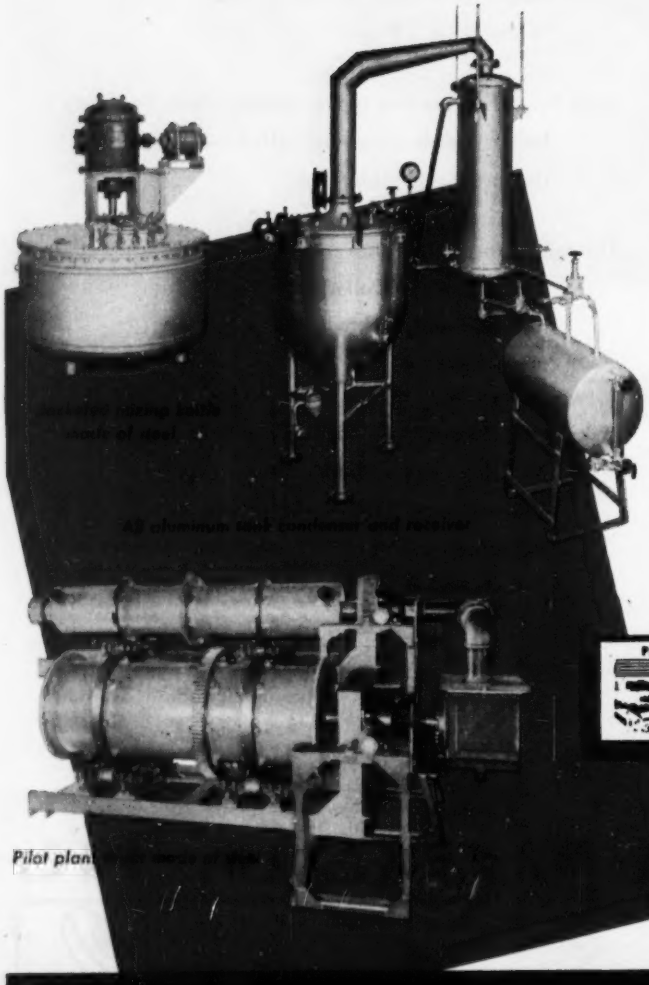
Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls RM 40B

BACK IN THE 1880's

WHEN MARK TWA[illegible] CREATED

"HUCK[illegible]BERRY FINN"

Koven



Pilot plan[illegible]

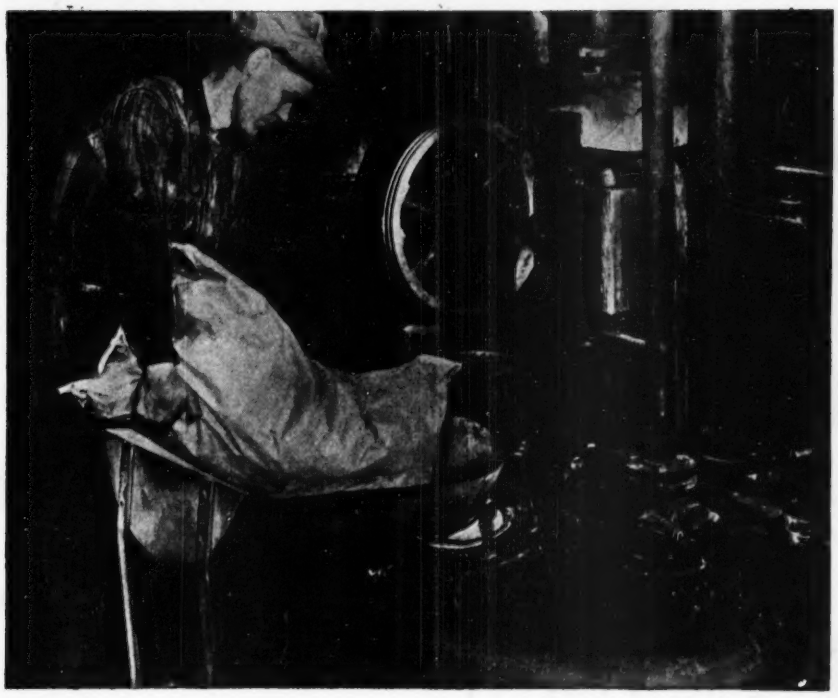
WAS MAKING INDIVIDUALIZED CHEMICAL EQUIPMENT

It was over 70 years ago that "Huck" Finn first piloted his raft down the Mississippi but, even then, KOVEN was speeding up production in the chemical industry with Individualized Chemical Equipment. Throughout the years, KOVEN has become a byword among leading manufacturers whose consistently high output proves that units tailored to your own exact needs mean faster production and dependable performance—even in the most complex operations. Result? Peak efficiency at minimum cost. If you have a production problem, one of our trained representatives will be glad to discuss it with you—of course, there is no obligation. Send for Facilities Catalog #490.

Complete modern facilities including X-ray inspection and stress relieving which insure quality control. KOVEN equipment in all commercial metals and alloys include: pressure vessels, extractors, mixers, stills, condensers, kettles, tanks, chutes, containers, stacks, breechings, coils. Fabrication to A.S.M.E. Code Par. U-68 and U-69 a specialty.

L. O. KOVEN & BRO., INC.
154-A Ogden Ave., Jersey City 7, N. J.

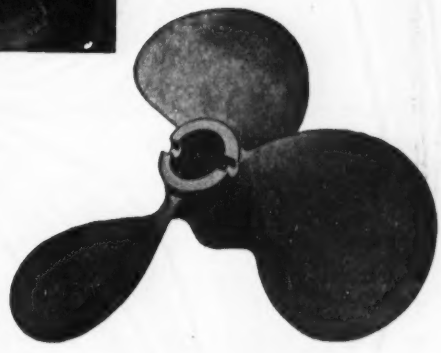
KOVEN FOR INDIVIDUALIZED EQUIPMENT SINCE 1881



Trouble-Free Production of Intermediates by Zinsser and Company, attests to the exceptional corrosion resistance of propellers, shafts, thermometer wells and blow-off lines fabricated from one of the high nickel-base alloys trade-named "Hastelloy," produced by Haynes Stellite Company, Kokomo, Indiana, a Division of Union Carbide and Carbon Corporation.

Still Good After 5 Years

in Hot H_2SO_4 and HCl



High Nickel-Base Alloy Cuts Maintenance. This propeller, made from HASTELLOY alloy D, is still in use after five years . . . mastering corrosion that caused propellers made from other materials to fall off and chip the kettle lining. Repairing kettles and replacing propellers were expensive maintenance items, heretofore.

Control of drastic corrosion has made possible the continuous trouble-free manufacture of intermediates during the past five years by Zinsser and Company, Hastings-on-Hudson, N. Y.

Zinsser uses a process that involves adding various aromatic organic chemicals, some of which contain chlorine, to a solution containing sulphuric acid. Since the solution is held in several 500-gallon kettles which are heated to 200° C., severely corrosive conditions arise from the resulting hydrogen chloride gas formed at this high temperature.

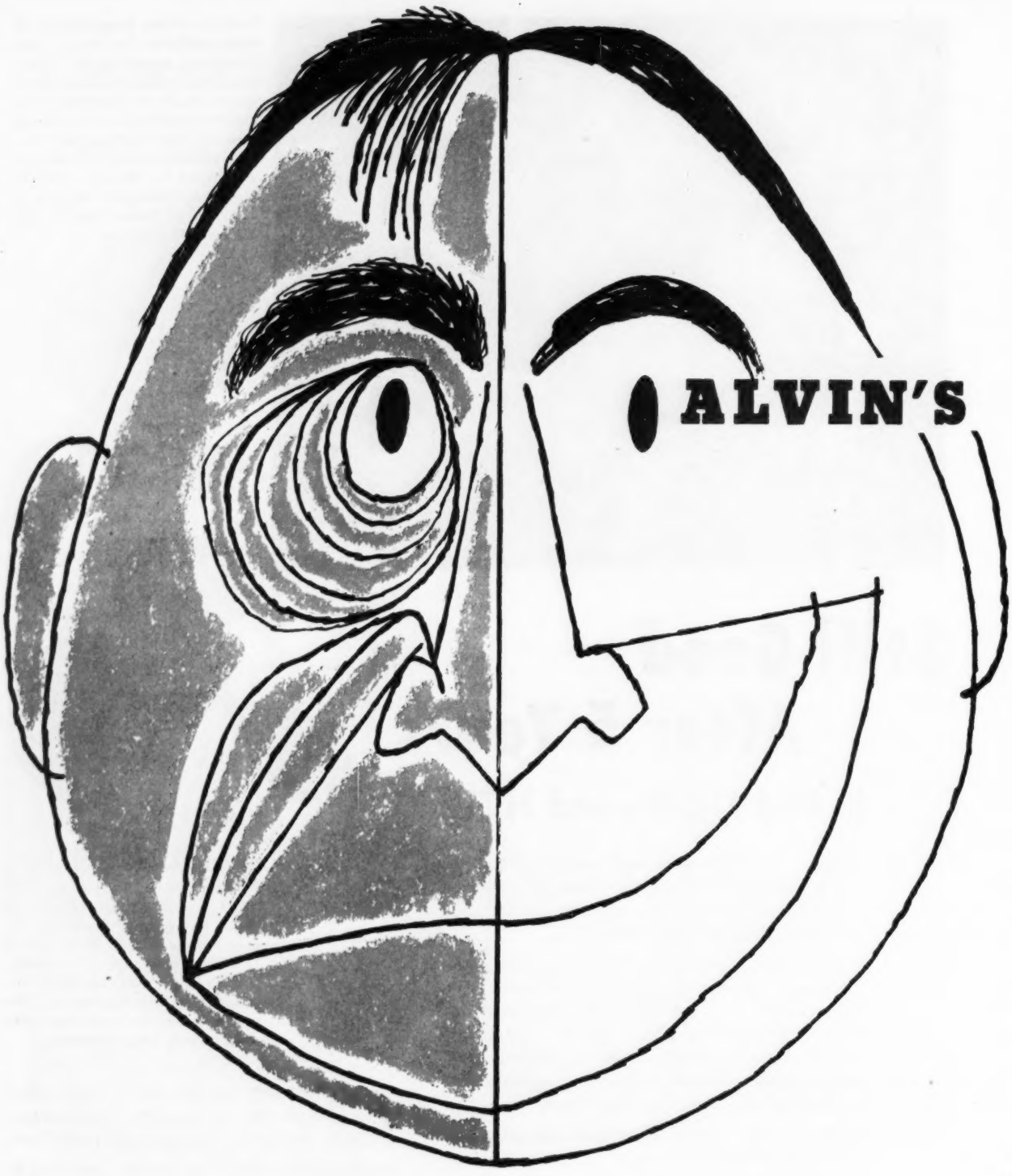
Nevertheless, a high nickel-base alloy . . . trade-named HASTELLOY alloy D . . . solves this particular problem, just as it has solved many others where exceptional corrosion resistance is needed at high temperatures.

Prior to using HASTELLOY alloy D, Zinsser found that equipment had to be replaced about every three months. Various materials were tried, but no improvement resulted until the high nickel alloy was put into service more than five years ago. And . . . it is still in use, reducing maintenance costs.

Wherever you encounter strong corrosives at high temperatures, let us help you. We offer counsel and data based on years of practical experience. Send details of your problem for our suggestions. Write today.

"Hastelloy" is a registered trade-mark of Union Carbide and Carbon Corporation.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.



more engineering-minded production men read it . . . more

ONLY HALF A HERO

Alvin is the fellow responsible for revamping Reader Service. Took over last fall with a whole new department and a passel of ideas to make this part of CE more rewarding and useful to readers.

Did fine too . . . completely changed the format, simplified classifications, slashed processing time for inquiries. To make it more convenient he instituted a postpaid card, even put in an extra one in case you come back to your copy again or an associate wants to use Reader Service. And you can thank Alvin for getting your request answered in a few days now instead of weeks.

He's a little crestfallen about one project, though. He thought you'd like brief little descriptions of the New Technical Literature in every Reader Service. Lots of extra work for him too . . . he reviews all the material and writes it up himself.

Don't know what he's worrying about because this section has proved immensely popular. But somehow Alvin's got the idea he dropped the ball. He estimated practically all of CE's readers would jump at the opportunity presented by this handy new service. Felt so sure he even told the boss.

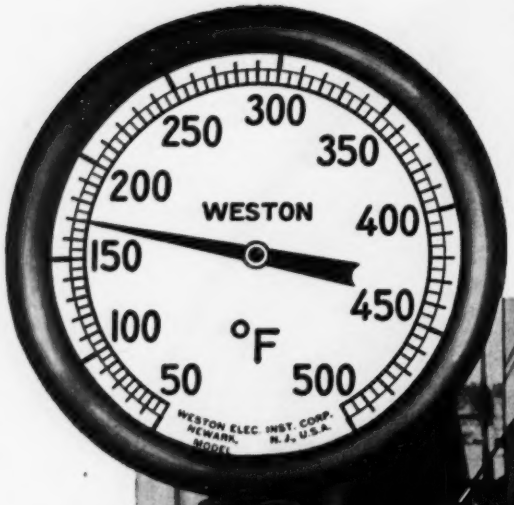
Truth is, the response has been swell. But not enough to suit Alvin. The way he figures it, everybody who reads the magazine should find this system helpful. And maybe he's right at that . . . it really is a wonderful way to help busy chemical engineers like yourself. Saves time because it digests the information for you.

We thought you'd like to know about it. Maybe even give this New Technical Literature section a try and see for yourself. Be awful nice to see that big grin back on Alvin's face again.

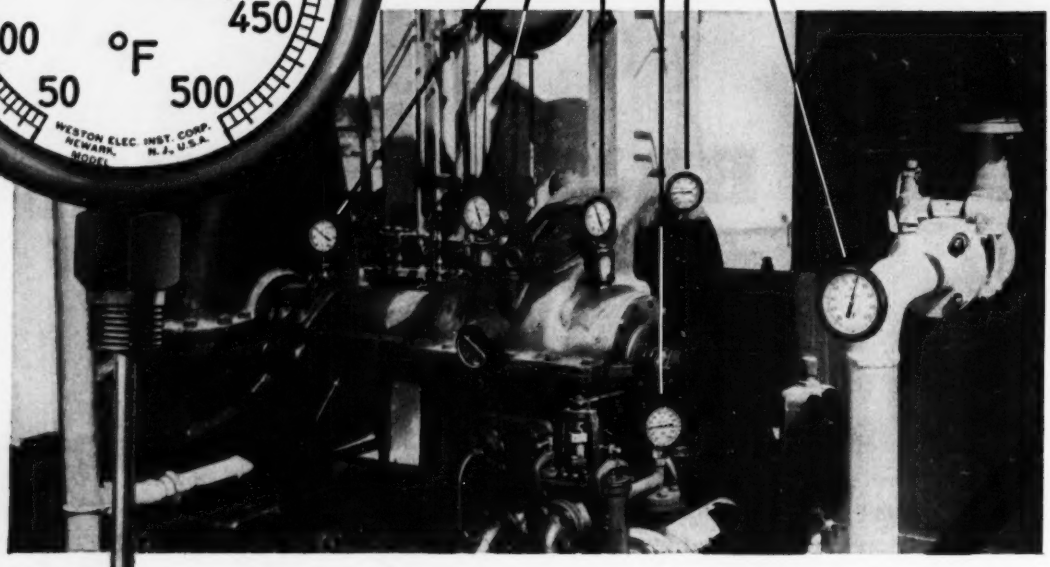
chemical engineers profit from it . . .

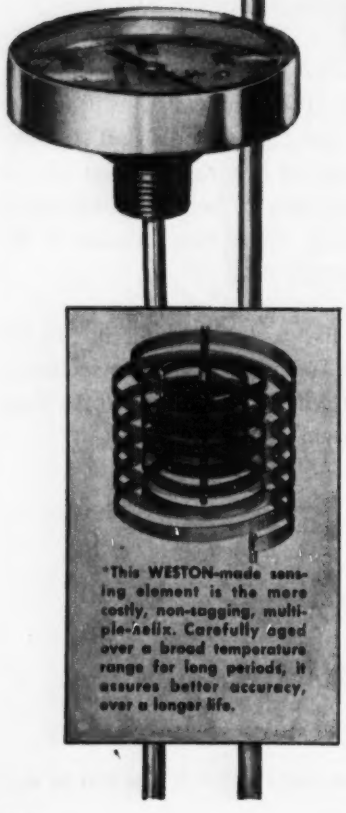
Chemical Engineering

A McGRAW-HILL PUBLICATION, 330 WEST 42nd STREET, NEW YORK 36, N. Y.



AT EVERY CHECKPOINT




*This WESTON-made sensing element is the more costly, non-sagging, multiple-helix. Carefully aged over a broad temperature range for long periods, it assures better accuracy, over a longer life.

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(with Multiple Helix)*

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Available in a broad selection of types, sizes, ranges and stem lengths, WESTON thermometers are today standard on all types of mobile and stationary equipment and machines, large and small; as well as on piping, conduit, ducts, etc. Ask your distributor, or local WESTON representative for complete information, or write for descriptive bulletin . . . WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

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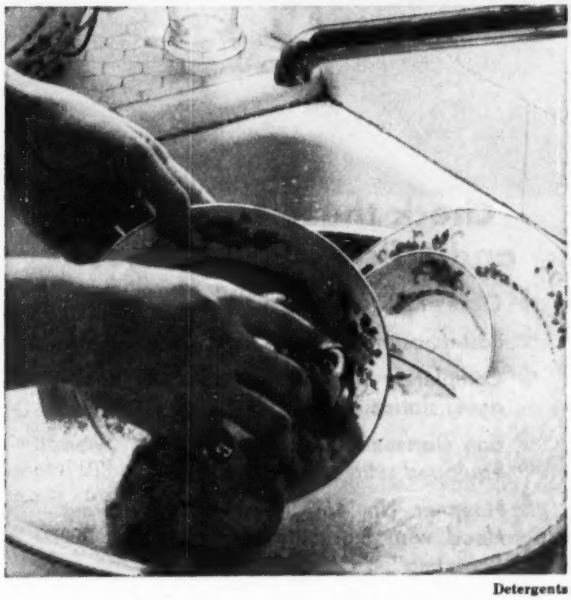

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Enjay supplies a complete line of uniform, high quality petroleum chemicals to the surface coating, chemical and petroleum industries. You are assured proved results with every Enjay product. Backed by 34 years of research, experience and know-how, each is designed to meet industry's most precise specifications and characteristics.

But don't consider Enjay for your present chemical needs alone – Enjay is also ready to assist in developing new or improved products through chemistry. Present or future, be *sure* to specify Enjay.

for a complete line of high quality petroleum chemicals

PETROLEUM	SURFACE COATING	CHEMICAL
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PARATONE	PETROHOL 95	PETROHOL 95
PARAFLOW	PETROHOL 99	PETROHOL 99
PARAPOID	JAYSOL	JAYSOL
PARADYNE	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROHOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Tridecyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
	Naphthenic Acids	Isopropyl Ether
	Iso-Octyl Alcohol	Tetrapropylene
	Decyl Alcohol	Tripropylene
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		Benzene
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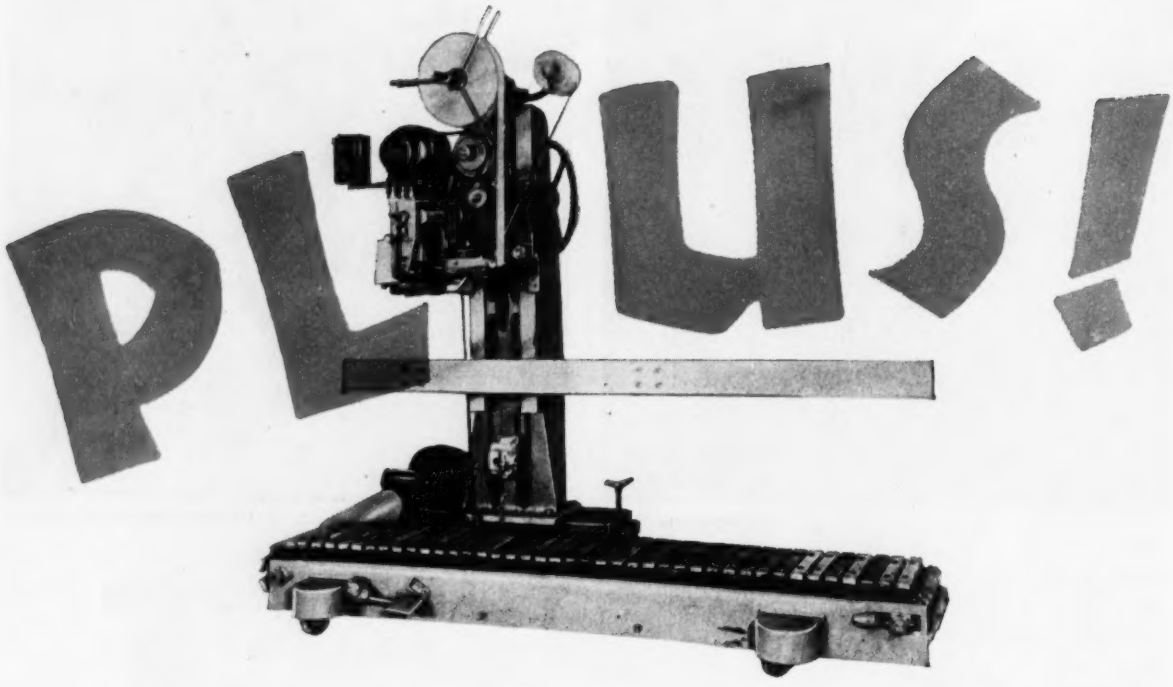
The Bag Closing Machine With a Real



There's an extra PLUS built into every model ET BAGPAKER delivered... the PLUS of assured day-in, day-out top performance.

The Model ET ties in with your existing filling and weighing equipment...closes open-mouth, multiwall paper bags semi-automatically... gives you sift-free, stronger, more economical bag closures with the famous BAGPAK cushion stitch.

You can count on the model ET BAGPAKER to give you faster packaging and better product protection...at lower cost.

Model ET applies famous "Cushion-Stitch" over dry tape for sift-proof closure. Model E-1 applies "Cushion-Stitch" only, for use where sift-proofing is not essential.

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Bagpakers available include models A, D-A, ET, E-I and F-I—with capacities from 60 tons per hour for the Model "A" to the small F-I where large volume is not required.

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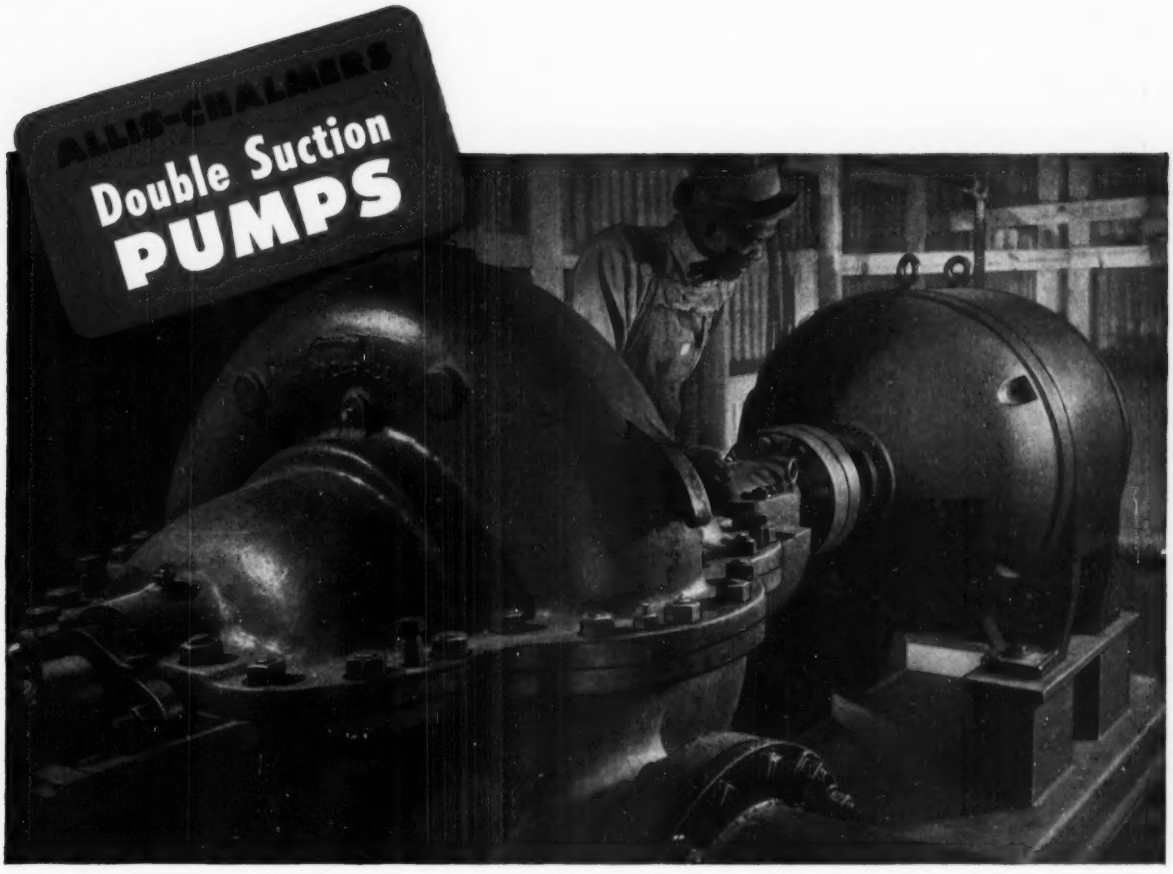

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Get an Allis-Chalmers pump with:

- **HEAVY DUTY CONSTRUCTION** — Extra metal thicknesses, extra strong parts, no skimping.
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FOR ALL GENERAL USES AND MANY SPECAL PROCESS APPLICATIONS, Allis-Chalmers double suction pumps are built with that extra measure of strength and ruggedness that assures you long life and low maintenance.

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TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

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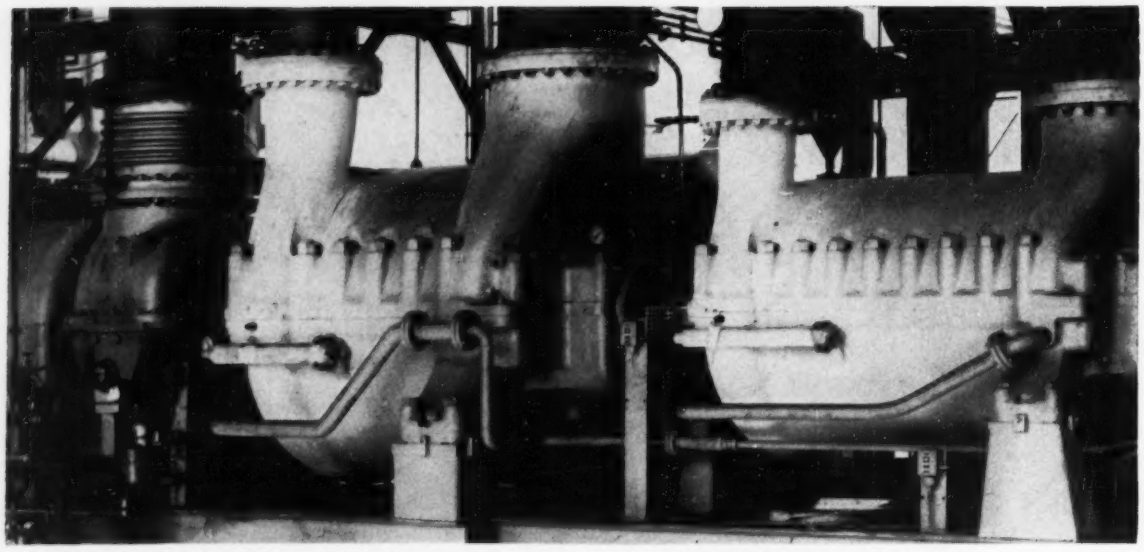


CENTRIFUGAL COMPRESSORS raise the pressure of incoming filtered air from 0 to 125 psig. in multiple stages.

Synthetic Ammonia

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

First application of partial oxidation process.

Spencer Chemical Co. recently started up a new synthetic ammonia plant at Vicksburg, Miss. Geared to turn out 210 tons per day of synthetic ammonia from natural gas, it's the first commercial unit to use the Texaco partial oxidation process for making hydrogen.

In the conventional ammonia process* feeding on natural gas, steam reacts with natural gas; then combines with air—resulting in a mixture of CO, CO_2, N_2 and H_2. After CO and CO_2 are removed, N_2 and H_2 are converted to ammonia.

In the Spencer unit, commercially pure oxygen is made in a liquid air plant. Natural gas is partially burned with oxygen under pressure (without a catalyst). The result is H_2 and CO. After removal of CO, the H_2 combines with N_2 (from the liquid air plant) to form ammonia.

▶ **Advantages**—The new process has several advantages over the conventional steam-methane reforming—(1) it can operate at lower pressures due to high purity synthesis gas, (2) about 15 percent less natural gas as raw material and fuel is needed.

▶ **Process Description**—Two raw materials are used—air and natural gas. Air supplies the nitrogen and natural gas the hydrogen for ammonia synthesis.

Filtered air is compressed to 125 psig. in centrifugal compressors, scrubbed with caustic, then raised in pressure to 600 psig. in gas engine driven reciprocating compressors.

A pass through a chiller and a bed of activated alumina prepares the air for the liquid air plant.

Here N_2 (99.99 percent pure) and O_2 are produced.

▶ **Partial Oxidation**—After preheating in a steam heated exchanger, the O_2 passes into the gas generator. Here it partially oxidizes the natural gas—which has previously been preheated and compressed to 1,000 deg. F. and 350 psig.

In the gas generator (a burner inserted in a refractory lined vessel) H_2 and CO are produced. In a shift converter—where steam is added—CO converts to CO_2.

▶ **Purification**—First this gas is scrubbed with a monoethanolamine solution; then with a caustic solution. This removes most of the CO_2.

After cooling and drying, the last traces of impurities in the hydrogen gas are removed in a nitrogen wash tower.

The gas—now pure hydrogen—with some nitrogen picked up in the wash tower—mixes with compressed nitrogen. The combination of N_2 and H_2—in the correct 1:3 ratio—receives additional compression to 3,600 psig. Then through a guard converter (to eliminate trace amounts of impurities) and into the ammonia converter.

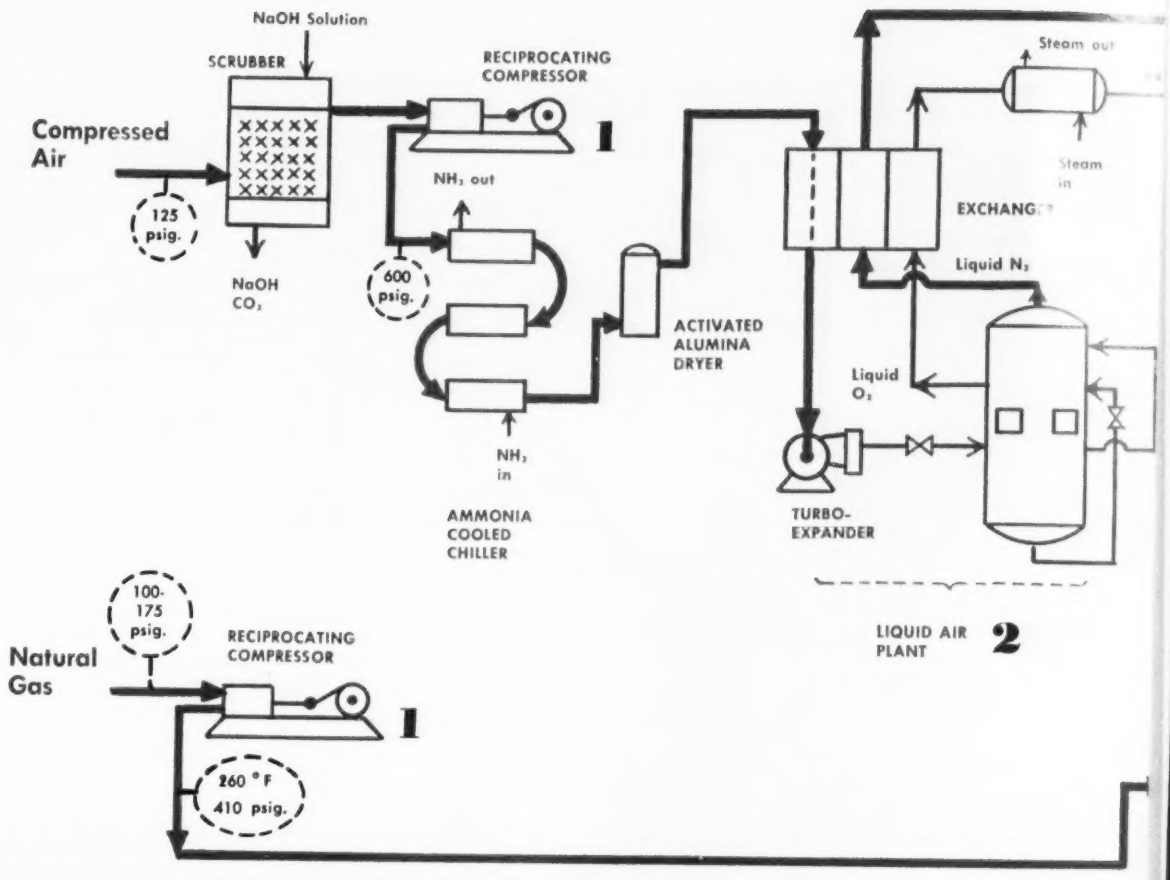
▶ **Conversion**—Here, at 3,600 psig and 900 deg. F. over an iron catalyst, nitrogen and hydrogen combine to form ammonia.

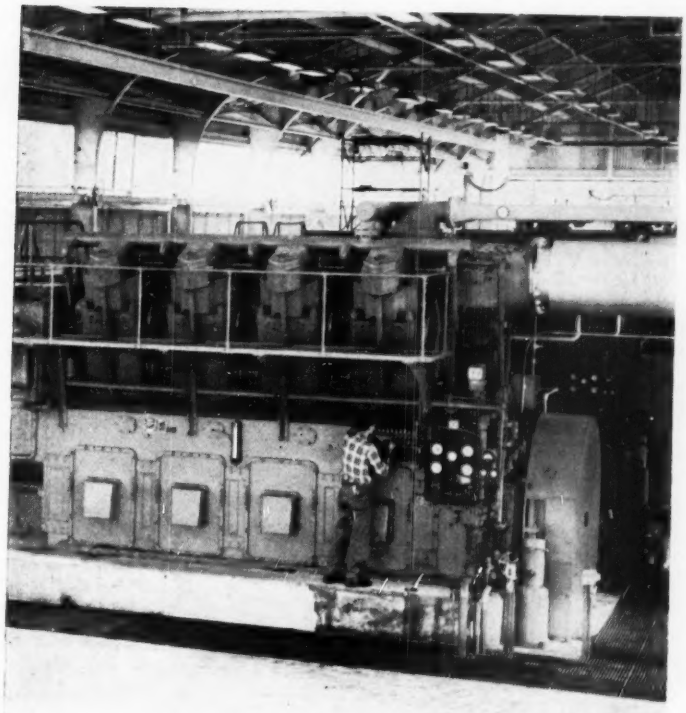
The ammonia is condensed, first in a water cooled condenser and then in a refrigerated condenser.

Unconverted gas is recirculated back to the ammonia converter by means of a German made centrifugal compressor.

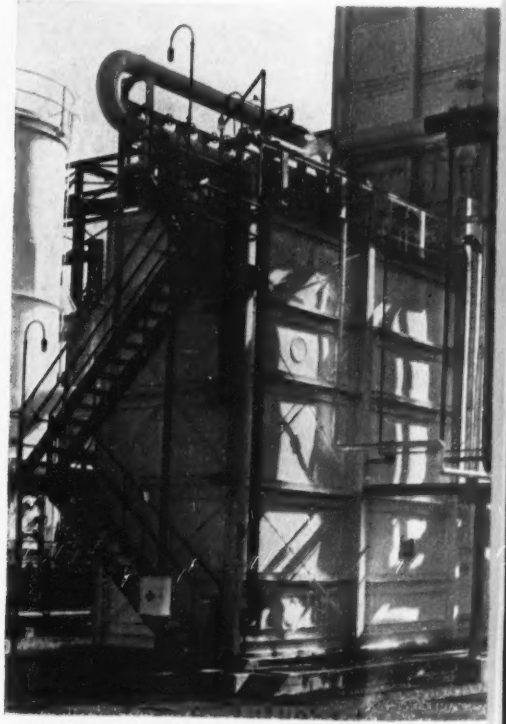
Ammonia liquid goes to storage in 1,500 ton Hortonspheres.

* See Chem Eng. August 1951, pp. 174-177, for details.

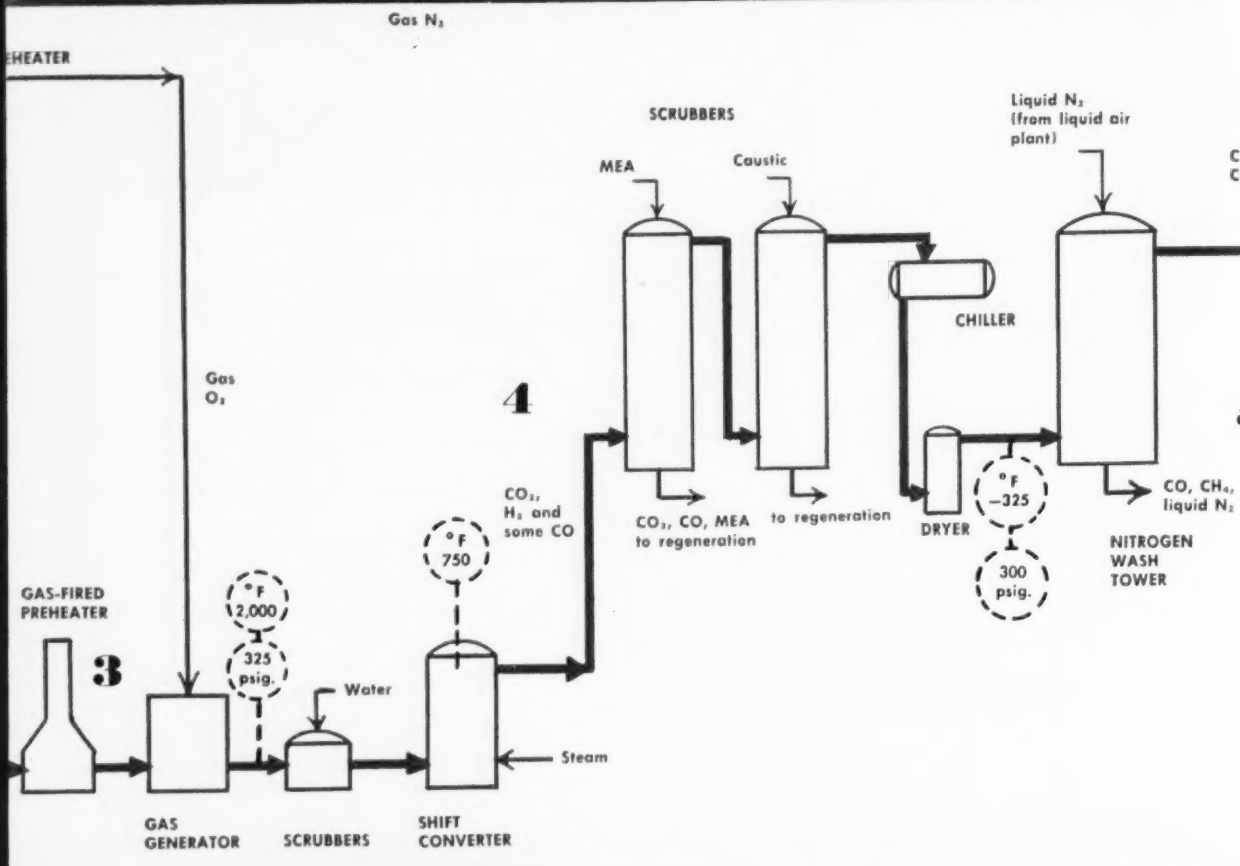




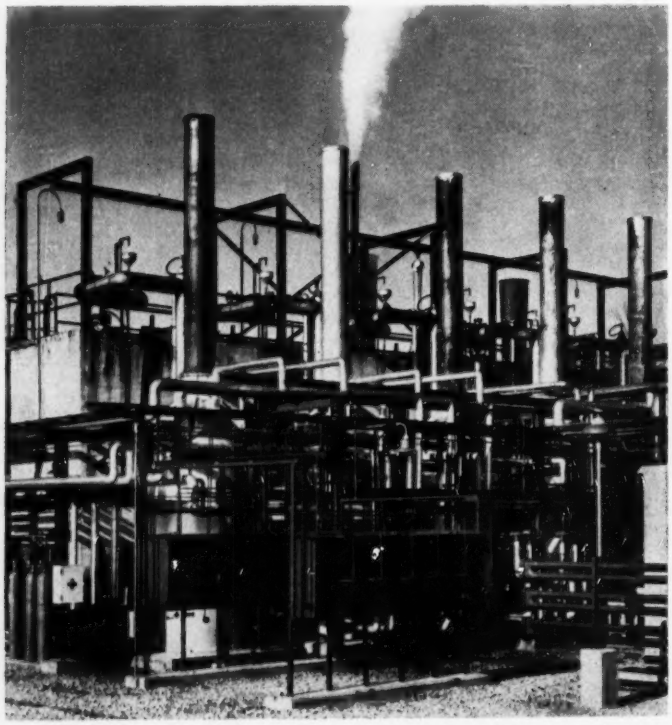
1 COMPRESSION of air, natural gas and N_2 takes place in reciprocating compressors. All three are compressed in the same units.



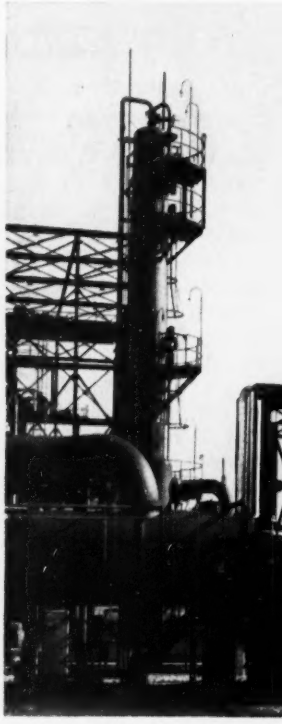
2 AIR SEPARATION PLANT handles 1,000 tons This is transformed into oxygen and nitrogen.



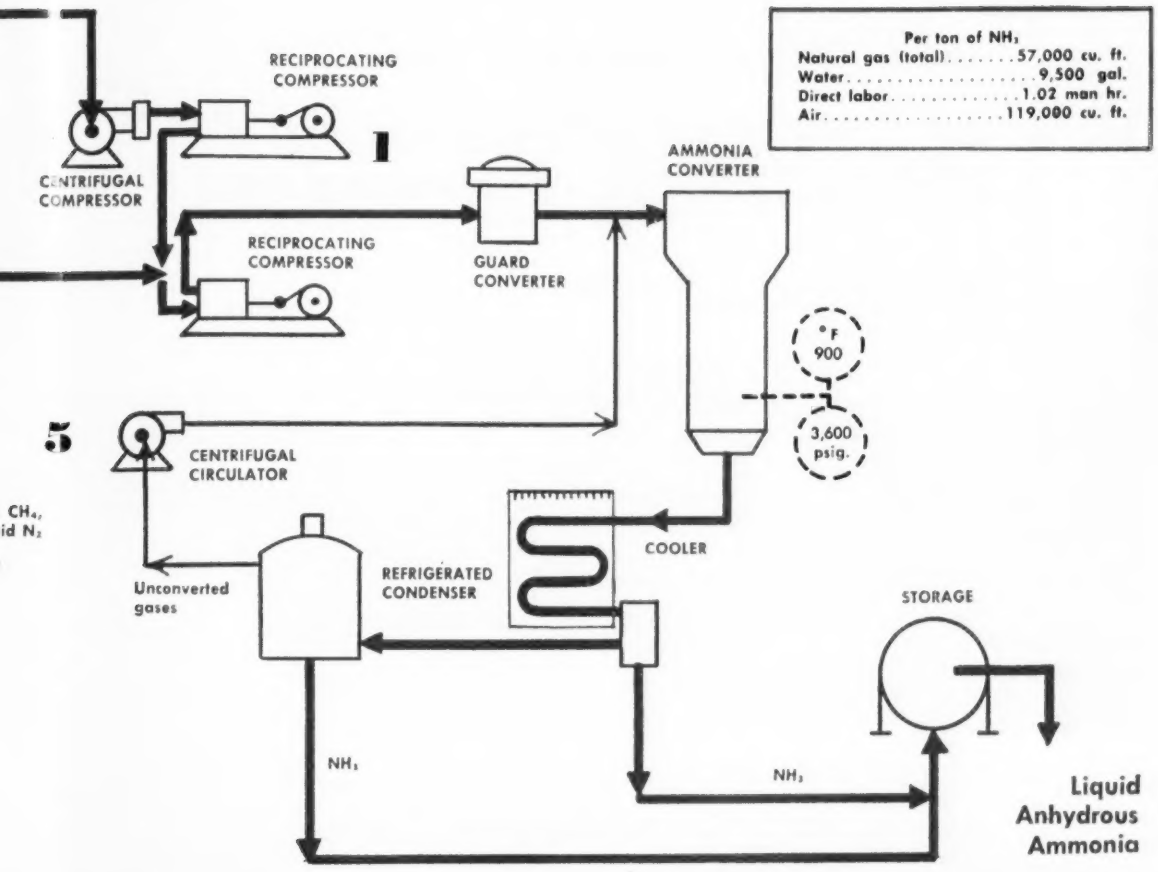
per day of liquid air.

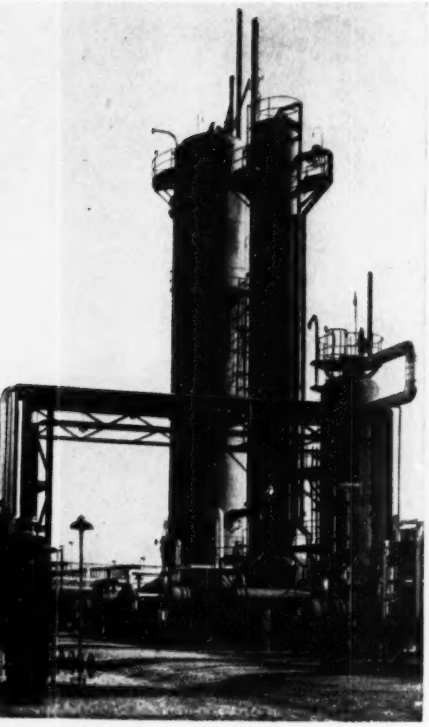


3 GAS PREHEATERS and hydrogen generators. Here natural gas is partially burned with oxygen, to form CO and H_2.

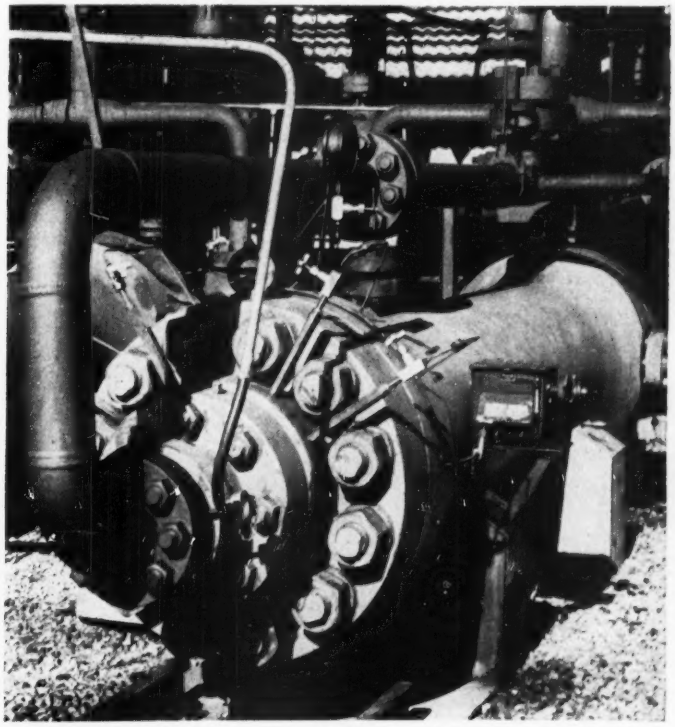


4 IN THE SHIFT CONVE
H_2 and CO_2. Scrubbing to





ONVERTER (extreme right), CO and steam form
ng towers (MEA and caustic) at the left.

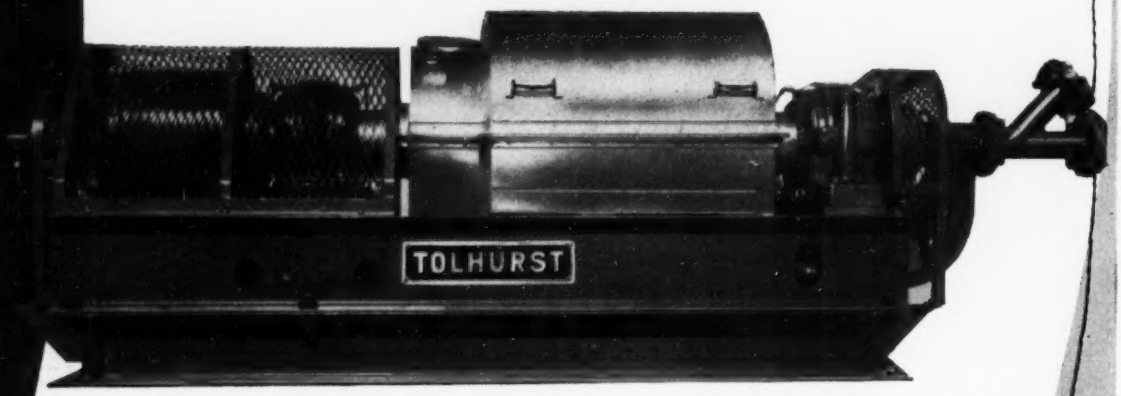


5 **CENTRIFUGAL** ammonia circulator is of German manufacture. It recirculates unconverted gases from the ammonia converter.

Quick, 3-Way Adjustability Makes

NEW "MAXI-FLEX" CONTINUOUS CENTRIFUGAL

most FLEXIBLE in field



NOW for the first time, continuous centrifugal users can profit from these 3 quick Tolhurst adjustability features:

1 ***VARI-BEACH***
is a hydraulic-mechanical combination drive with hand wheel control. It allows instantaneous selection of the beach speed from 0 to 300 inches per minute.

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provide a choice of seven different pool depths by simple adjustment.

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aids a difficult separation. The Tolhurst "Maxi-Flex" Continuous user has a centrifugal force field which can be varied up to almost 2,000 times gravity.

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Self-cleaning feed chambers allow maximum utilization of this machine's flexibility features. Full ball and roller bearings permit more compact inner bowl design. This design feature minimizes bowl deflection even when processing viscid materials at high speeds.

Decide now to investigate the advantages of Tolhurst "Maxi-Flex" Continuous Centrifugals. Use the convenient coupon below.

FREE 90-DAY TEST IN YOUR PLANT

If you are presently using continuous centrifugals or would like to investigate their application, ask for details about Tolhurst's offer to supply a machine for processing tests on your materials in your plant.

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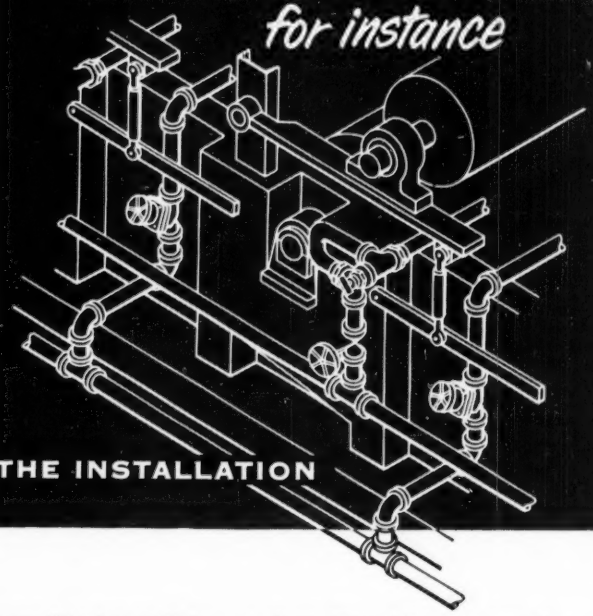
Doing What Other Valves Couldn't ...on Slurry Service, for instance



Crane Diaphragm Valves on slurry-like white water service to cylinder tanks on paper-making machines at Excello Paper Products Co., Inc., Cincinnati.

VALVE SERVICE RATINGS

SUITABILITY:
"Made to Order" for tough jobs

FEATURES:
Seats tight where others fail

MAINTENANCE COST:
None - needs no attention

SERVICE LIFE:
Many times longer than expected

OPERATING RESULT:
Plant efficiency improved

AVAILABILITY:
Crane Catalog item - No. 1610

THE CASE HISTORY

Valves formerly used had been giving much trouble that started between tank fillings. While many replacements were tried, none of the valves could handle the white water solids and fibers that built up in the bonnet and seats between operations. Result was the valves were hard to operate, and leaked at the seats.

Keeping up with valve maintenance and the hazardous, messy floors caused by white water leakage was costly and annoying. But it was a problem that Crane Diaphragm Valves solved handily. The leakage stopped—machine room efficiency went up as the safety hazard was gone—plant appearance improved. Installed about a year ago, Crane Diaphragm Valves keep doing these things without a penny's maintenance cost to date.

THE VALVE

Crane Diaphragm Valves are packless. Bonnet and working parts are sealed to line fluid; there's no place for sediment to build up. Independent disc and diaphragm design saves wear on diaphragm, permits valve to be closed even should diaphragm fail. Pliable disc insert seats tight on foreign particles that cause leakage and wire drawing in ordinary valves. Choose these valves from wide variety of body and trim materials for corrosive, abrasive, and ordinary services. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

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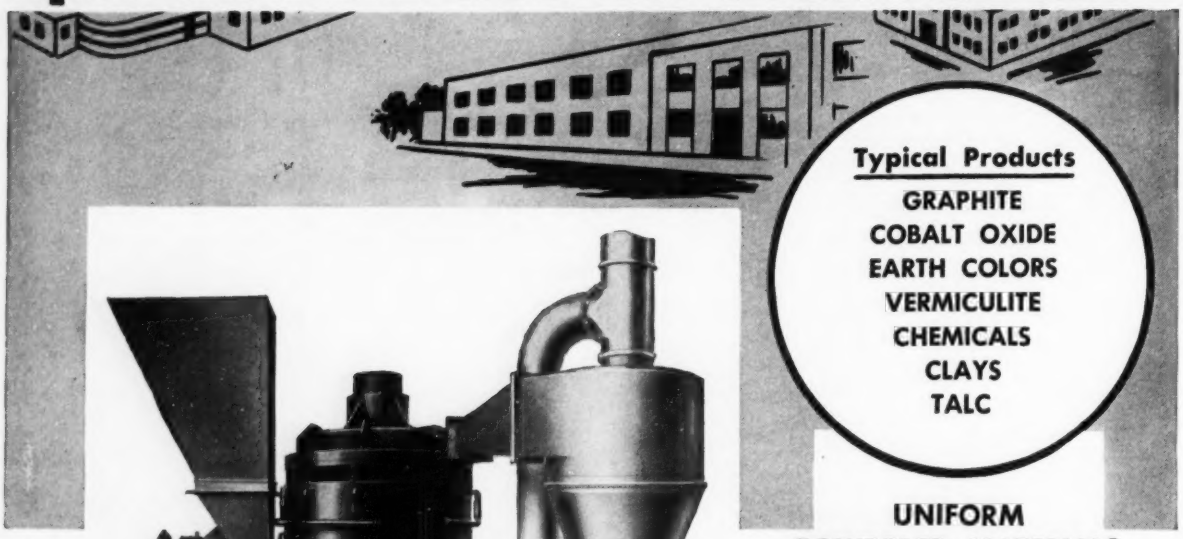
Open New Markets for YOUR PRODUCTS



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CLAYS
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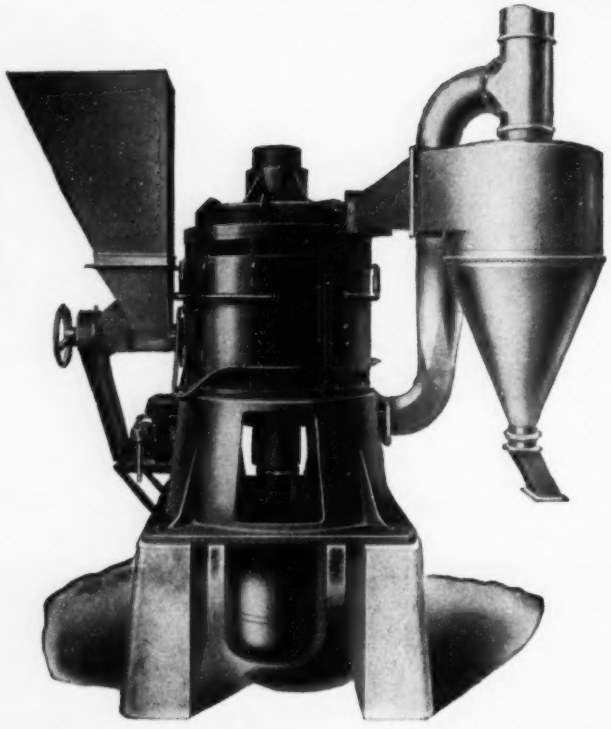
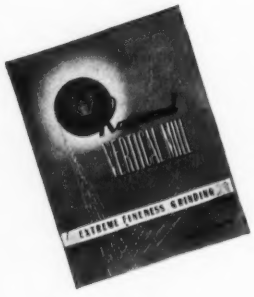
UNIFORM POWDERED MATERIALS produced in Sub-Sieve Sizes





WITH THE RAYMOND VERTICAL MILL

This compact high-speed pulverizer offers an economical means of making super-fine materials to meet today's high specifications. It permits the production of premium products that open the way to wider markets and greater profits.

The Vertical Mill helps to improve the qualities in many materials such as producing finer and smoother texture, better processing properties and extreme fineness and uniformity of particle size. This mill is capable of going well beyond the fineness obtainable with ordinary mills.

On many materials, finenesses of 100% passing 325 mesh are available, and some products can be produced at finenesses of 95% to 99% finer than 10 to 15 microns. Whizzer separation is effective in keeping over size from the finished product and insuring consistent uniformity. *Write for Bulletin No. 70.*

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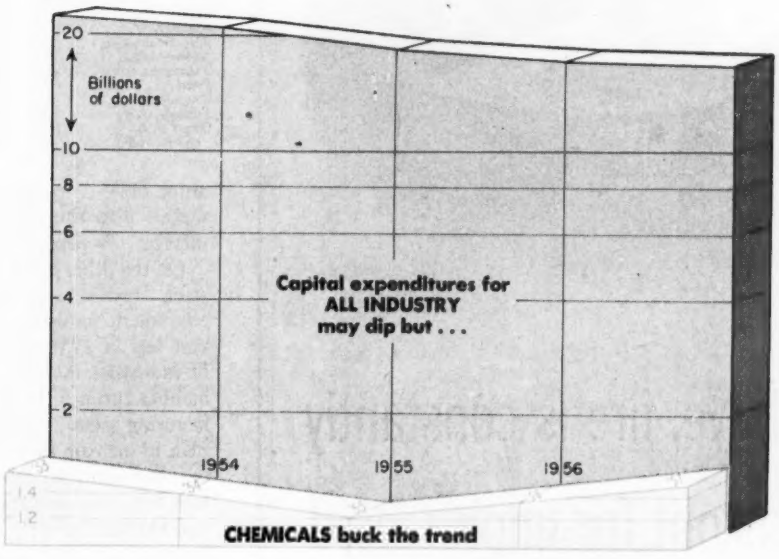
Chicago 22, Illinois
Sales Offices in Principal Cities



We Modernize . . . . . Or Else!

More modernization, higher productivity, fewer new plants. These are business plans for meeting competition according to the seventh annual McGraw-Hill survey.

Industry plans to spend $21,499 million for new plants and equipment in 1954. That's just 4 percent less than the record amount spent in 1953. Manufacturing industry plans to spend $12,302 million this year, almost exactly the same as in 1953. These are some of the results of the seventh annual McGraw-Hill survey of business plans for new plants and equipment.

▶ **Actual Company Plans**—This survey is not a forecast, but a summary of plans and expectations reported by industry. Thus, it reflects the intentions of industry at the time the survey was made late in the first quarter of 1954.

Trends in capital spending vary widely between industries. Within manufacturing, increased purchase of new plants and equipment is planned by petroleum, food, machinery, electrical machinery and

U. S. Industry Capital Expenditures—Actual and Planned—Millions of Dollars

	1953*	1954	1955	1956	1957
Steel	1,340	1,139	831	866	820
Machinery, except electrical	803	869	748	682	686
Electrical machinery	481	553	359	348	310
Automobiles	1,000	1,290	1,045	851	710
Transport equipment	168	143	80	24	20
Petroleum, coal products	2,762	2,983	2,804	2,744	2,625
Textiles	351	317	341	339	334
Food	818	865	690	641	607
Chemicals	1,559	1,379	1,216	1,342	1,476
Other manufacturing	2,994	2,764	2,311	2,268	2,368
ALL MANUFACTURING	12,276	12,302	10,425	10,095	9,956
Mining	1,011	1,102	1,003	672	661
Railroads	1,312	1,010	949	990	970
Electric, gas utilities†	4,548	4,366	3,755	3,536	3,536
Other transportation, communication	3,158	2,719	2,072	1,921	1,904
ALL INDUSTRY	22,305	21,499	18,204	17,214	17,027

* U.S. Department of Commerce. † Electrical World, American Gas Association, McGraw-Hill Department of Economics

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ECONOMICS . . .

How Industry Is Expanding Capacity

Index of Industrial Capacity (1939 = 100)

	Jan. 1946	1953	Planned for 1954	Planned for 1957
Steel	112	147	150	153
Machinery	154	325	338	368
Electrical mach.	175	452	493	562
Automobiles	104	202	210	221
Transport equip.	243	495	530	546
Food	117	162	172	184
Chemicals	172	393	421	514
Petroleum ref.	123	208	216	225
Other mfg.	109	157	162	178
ALL MFG.	131	218	227	247

automobile companies. Auto makers plan the largest percentage increase—29 percent.

On the other hand, the chemical, steel, textile and transportation equipment industries expect to invest less in 1954, as do the group of industries lumped under "other manufacturing." In the nonmanufacturing sector, mining companies plan to increase their capital spending, but railroads, other transportation and communication companies and electric and gas utilities expect to spend less than in 1953.

▶ **High Through 1957**—Industry already has plans to maintain a high level of spending for new plants and equipment in the years 1955-1957. Manufacturing industries report intentions to spend an average of $10,157 million a year during this period, and all industry together has plans for an average annual expenditure of about $17,482 million.

Plans for 1955-1957, are, of course, tentative and subject to change if the general economic picture changes or if management alters its thinking. But, with this qualification, they are a significant guide to the possibilities of future growth in different industries.

▶ **Chemicals Buck the Trend**—The chemical industry is almost unique among major industries in planning to spend a larger amount in 1957 than in 1954. Only textiles, among the other major industries, now plan to increase capital spending over this period. Chemical companies plan a 7 percent increase between 1954 and 1957, while textile plans are up 5 percent.

Among the other industries, the greatest decreases in capital spending plans are reported by industries that are just completing major expansions in connection with the de-

How Industry Is Expanding Capacity

	Percent Increase		
	1952–53	1953–54	1954–57
Steel	5	2	2
Machinery	7	4	9
Electrical mach.	13	9	14
Automobiles	3	4	5
Transport equip.	17	7	3
Food	3	6	7
Chemicals	10	7	22
Petroleum ref.	7	4	4
Other mfg.	6	3	10
ALL MFG.	7	4	9

fense program, combined—especially in the case of automobiles—with big growth in facilities for producing civilian products. The largest single decline is reported by companies in the transportation equipment industry—mostly aircraft—which expect to invest 86 percent less in 1957 than in 1954.

Manufacturing industry intends to increase its productive capacity by about 4 percent in 1954 and by another 9 percent by the end of 1957. Added to the 7 percent increase in capacity last year, this means that manufacturing industry will have expanded by more than 20 percent in the five years, 1953-1957, if all present plans are carried out. Thus, United States manufacturing capacity in 1957 is expected to average 147 percent above 1939. These figures from the McGraw-Hill survey are the only comprehensive statistics that exist on changes in manufacturing capacity since 1939.

▶ **Three Leaders**—The electrical machinery, chemical and transportation equipment industries plan the largest increases in capacity in 1954—9, 7 and 7 percent, respectively. Other major manufacturing industries plan to grow at varying rates.

Steel's very small planned increase in capacity—2 percent—is probably accounted for by the fact that the industry has just about completed a tremendous expansion program stimulated by the post-Korea defense program, and is now operating well below its new capacity.

Chemical and electrical machinery companies also plan the fastest expansions over the longer pull. Chemical companies expect to add 22 percent to their capacity in 1955-1957. Electrical manufacturing has plans for a 14 percent ex-

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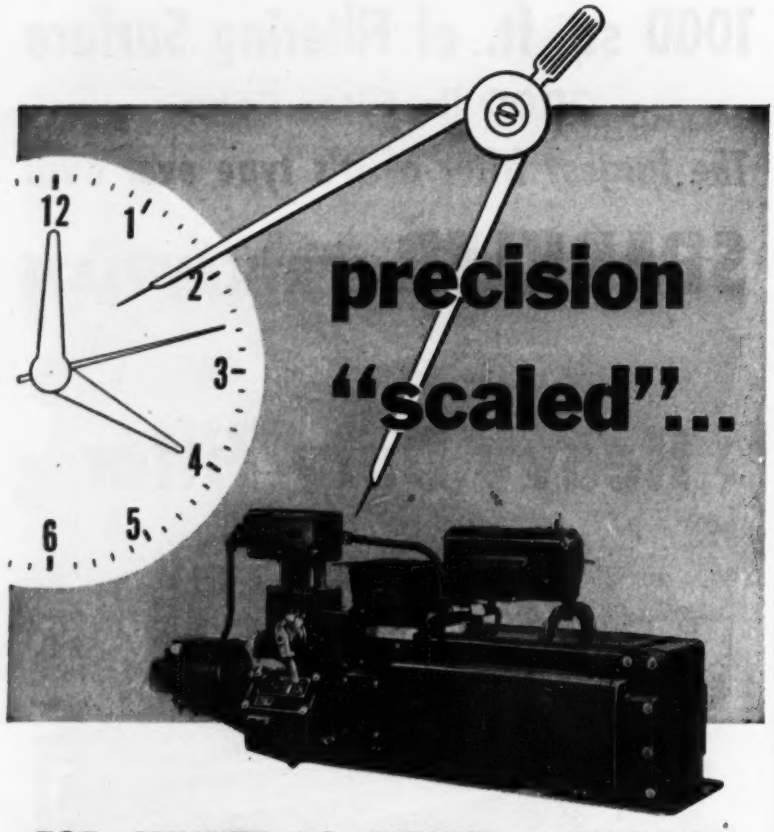

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pansion. Other industries with large expansion plans are nonelectrical machinery and food. Only the steel, transportation equipment and petroleum industries plan to grow markedly slower than the average for all manufacturing.

▶ **How Reliable?**—Businessmen have been excellent prophets of their future gains in capacity. Last year, for instance, they reported plans to increase capacity in manufacturing by 7 percent in 1953—and they hit that figure exactly on the nose when the returns from this year's survey were added up. They have done just about as well in the past.

Accuracy of capacity plans is not uniform in all industries. Some of the industries overshot the marks they set for themselves early in 1953. Others increased more slowly than they expected. But three industries increase capacity by the exact figure they had planned—food, chemicals and electrical manufacturing. Interestingly enough, two of these are the two industries that plan the largest increases in capacity in 1954 and again in 1955-1957—chemicals and electrical machinery.

Plans for increased capacity in 1954—at a time when sales in many industries are running lower than they were a year ago—obviously imply greater competition in the market place. And other results of the McGraw-Hill survey indicate that industry is planning on tougher competition in the next few years.

▶ **I'm Growing Faster Than You**—Sales estimates bear out the expectations of rising competition. Companies were asked to estimate how fast their own sales would grow between 1953 and 1957. They were also asked to estimate how fast the sales of their industries would grow in the same period. With strikingly few exceptions, businessmen reported that their own companies would grow faster than the competition.

Manufacturing companies expect their sales to grow by an average of about 12 percent between 1953 and 1957. Electrical machinery and chemical companies expect the fastest growth—35 and 30 percent, respectively. All industries except

How Sales Will Change

(Average percent change)

	Company 1953–54	Company 1953–57	Industry 1953–57
Steel	−19	0	0
Machinery	−6	10	2
Electrical mach.	1	35	18
Automobiles	−11	9	7
Transport equip.	−2	−20	−30
Food	7	15	7
Chemicals	1	30	19
Petroleum, coal prods.	4	16	13
Textiles	−5	11	4
Other mfg.	−1	13	4
ALL MFG	−2	12	4

steel and transportation equipment expect some increase.

But these same companies expect sales in their industry to grow by an average of only 4 percent between 1953 and 1957. In all industries except steel, individual companies expect to increase sales far faster than their competition.

Some of the differences are striking: Chemical companies expect their sales to grow 30 percent, industry sales to grow 19 percent; electrical machinery companies expect gains of 35 percent, industry gains of only 18 percent; food companies expect to expand sales twice as fast as their industry expands.

▶ **Sales Down This Year**—For the shorter run—1954—manufacturing companies as a group expect lower sales than in 1953. They think their sales will be down about 2 percent, on the average, this year.

But companies in some industries expect increases—chemicals, petroleum, food and electrical machinery. Without exception, these are also the companies that anticipate the largest gains in sales over the longer pull, 1953-1957. The largest declines in 1954 sales are anticipated by the steel and automobile industries, which enjoyed unusually good years in 1953.

▶ **Modernize!**—Another indication of increasing competition shows up in the breakdown of the purposes of capital expenditures. During the rapid industrial growth in the first years after the Korean War started, industry devoted a large part of its capital funds to building new capacity to meet the great demand for goods both for the military and for growing civilian markets. But more recently, there's been a marked shift toward spending more for replacement and mod-

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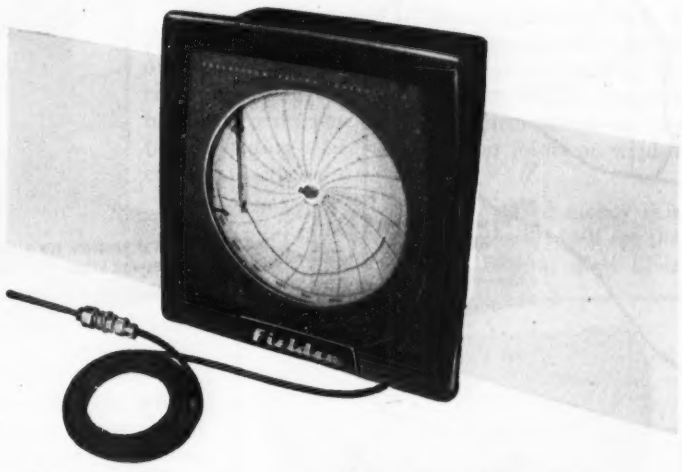

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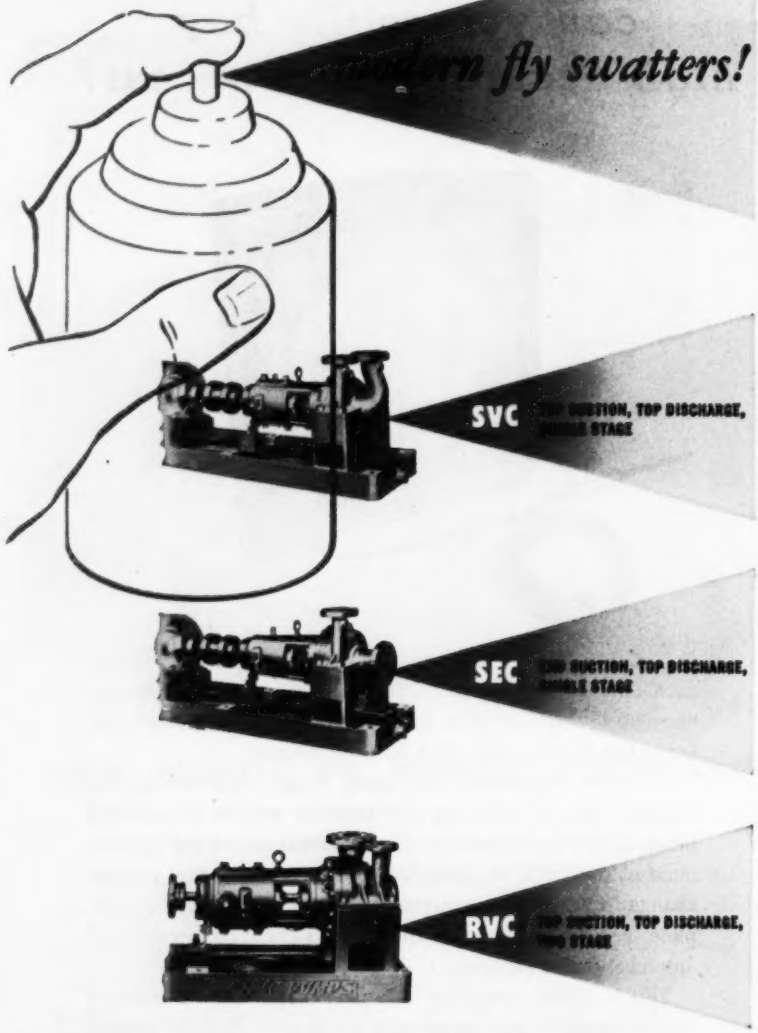

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ECONOMICS . . .

Expansion vs. Modernization

(Percent of Total Expenditures)

	1953		1954		1955-57	
	Exp.	Mod.	Exp.	Mod.	Exp.	Mod
Steel	48	52	16	84	14	86
Machinery	55	45	53	47	45	55
Electrical mach.	60	40	61	39	38	62
Automobiles	35	65	36	64	21	79
Transport equip.	57	43	24	76	8	92
Food	41	59	37	63	30	70
Chemicals	70	30	66	34	67	33
Petroleum, coal prods.	46	54	47	53	36	64
Textiles	10	90	10	90	7	93
Other mfg.	45	55	42	58	47	53
ALL MFG.	48	52	43	57	39	61

ernization of existing facilities, less for additions to capacity.

Industry reports that this shift will continue in 1954 and 1955-1957. Manufacturing industry as a whole plans to use 57 percent of its capital outlays in 1954 to replace old plants and equipment. In 1955-1957 the share for modernization is expected to rise to 61 percent of capital spending.

By comparison, manufacturing companies report that they spent 52 percent of their capital investment in 1953 for replacement and modernization, 51 percent in 1952.

The object of this shift, in the case of most industries, is to cut costs by using more efficient modern plants and equipment. And that obviously ties in with the widespread intention of manufacturing companies to beat the competition and expand their own shares of the market.

▶ **Chemicals Balk** – The chemical industry is an exception to this general trend. It customarily spends a much higher percentage for new capacity than most other industries. In 1953, chemical companies devoted 70 percent of their capital spending to capacity expansion, compared to 48 percent for all manufacturing companies together. Under present plans, chemical companies will cut this percentage only a little. They still plan to use about two-thirds of their capital expenditures in 1954 and 1955-1957 for new capacity.

Industries classified under "other manufacturing" will actually increase the percentage going for new capacity, but all other manufacturing industries plan cuts.

The most striking shift is that planned by transportation equipment companies–which are also ex-

pecting the greatest decline in total capital spending. This shift and cut in total spending are direct results of the expected decline in defense spending and the generally unpredictable nature of world affairs, which heavily influences orders for military aircraft.

▶ **Higher Productivity**—The results of greater emphasis on replacement and modernization of old plants show up in industry's expectations of future employment. Manufacturing companies as a group are expecting an increase in sales between 1953 and 1957 of about 12 percent. But companies expect their employment to increase by only 4 percent over the same period.

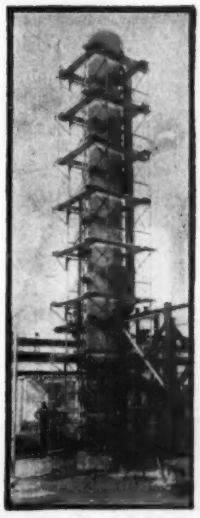
Thus, industry expects its greater emphasis on more efficient machinery to pay off in lower unit costs—which all fits in with the expectations of rising competition in the next few years.

▶ **How Firm are Plans?**—Business can, of course, change its investment plans. Manufacturing companies participating in the McGraw-Hill survey report that they have considerable leeway—up and down—for adjusting plans if business conditions should change.

Companies were asked what was the *minimum* amount they would invest annually in the years 1954-1957, even if their sales declined substantially. They were also asked what was the *maximum* amount they could invest if they were able to take advantage of all technological developments in their industries.

Manufacturing industry as a whole reports that its 1954 investment program is about 15 percent below the maximum that could be spent under ideal conditions, nearly double the minimum it would spend if sales dropped badly. So obviously there's a lot more leeway on the down-side than on the up.

But that's not so true for 1955-1957. Present plans for spending in 1957, for instance, would reach the minimum level if they were cut only one-third. And they are well below the maximum possible. Presently planned expenditures in manufacturing for 1957 could be in-



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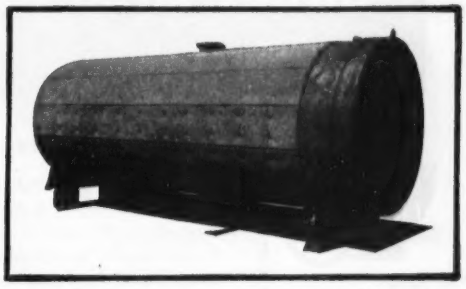

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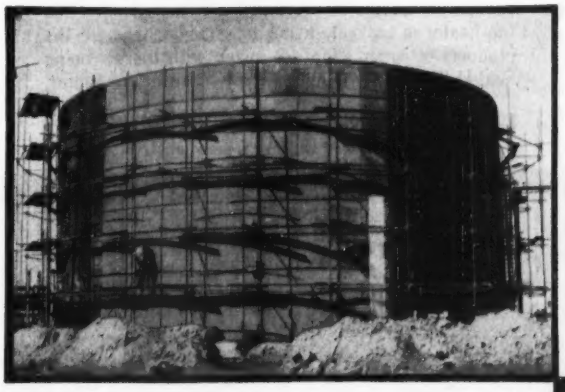

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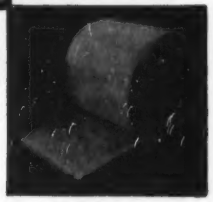

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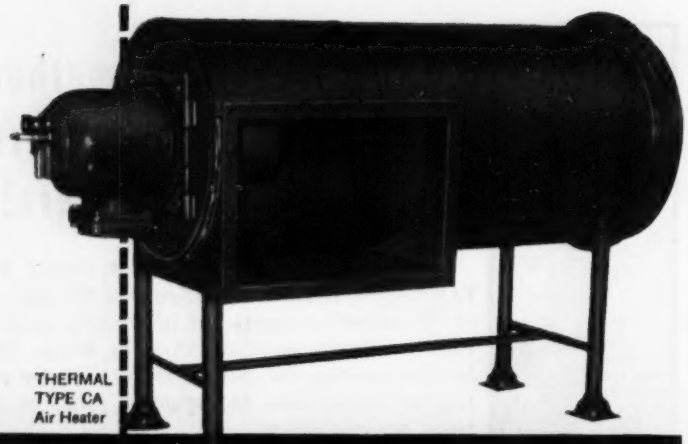

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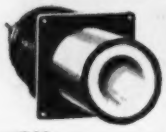

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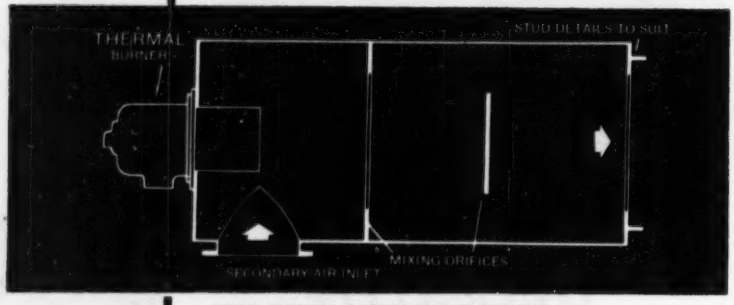

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ECONOMICS . . .

Capital Spending Under Changing Business Conditions

(Millions of Dollars)

	Planned 1954	Average 1954–57 Minimum	Maximum
Steel	1,139	434	1,560
Machinery	869	397	954
Electrical mach.	553	210	481
Automobiles	1,290	542	1,187
Transport equip.	143	30	124
Food	865	417	1,236
Chemicals	1,379	758	1,784
Petroleum, coal prods.	2,983	1,939	2,953
Textile	317	245	567
Other mfg.	2,764	1,542	3,591
ALL MFG.	12,302	6,514	14,437

creased 44 percent before they hit the maximum figure reported.

▶ **Chemicals Are Average**—The chemical industry shows about the same range of possibilities as manufacturing industry as a whole – just a bit higher on both ends. The greatest leeway for increasing expenditures from the 1954 level appears in the food, textile and steel industries, while transportation, electrical machinery and steel companies (again) have the greatest leeway on the down side.

▶ **About the Survey** – The companies cooperating in the McGraw-Hill survey employ more than 60 percent of all workers in the group of industries where capital investment is highest, including chemicals, oil, railroads, autos, utilities and steel. The companies included in the sample are usually the larger companies in their industry.

Coverage in other industries is not as complete, but companies are carefully chosen to provide a representative cross section of their industry. Companies included in the sample employ a total of more than 6 million workers, about one quarter of the total employment of all industry.

Physical capacity is measured by the companies themselves, using their own measures. The figures that result are the only available direct measures of the expansion in industry since 1939. These figures are directly comparable with those published from previous McGraw-Hill surveys. The dollar figures used in the report, however, have been put on the same base as those published by the Department of Commerce for the years 1945-1953. The Department of Commerce figures should therefore

be used for comparisons of dollar expenditures.

The survey results take no account of changes in the value of the dollar; they are strictly dollar measures, not measures of the physical volume of capital expenditures.

Capital spending by the electric utility companies was made available by *Electrical World*, a McGraw-Hill publication. The American Gas Association supplied figures for gas utilities. Correspondents for *Business Week* personally interviewed many company executives and other McGraw-Hill magazines helped in conducting the survey in their own fields.

Glycerine Supplies To Remain High

There's little doubt that the supply of glycerin will meet all demands this year, according to the Association of American Soap & Glycerine Producers. Past "feast or famine" effects that have driven consumers to seek substitutes for glycerin or to anticipate a market glut should be nonexistent.

The 1953 domestic output is estimated at 218 million lb.—30 million above 1952. And this gain was made in the face of falling soap production.

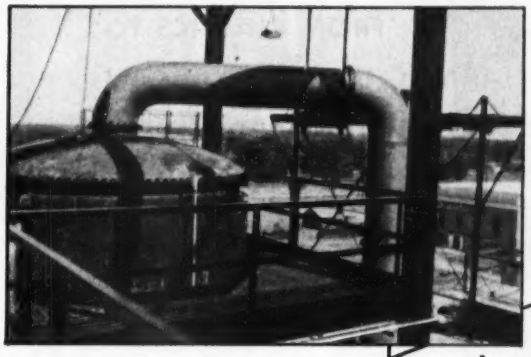
Two factors were responsible for this happy situation: use of better grade fats in soap making with a proportionate increase of higher soap grades where glycerin yields are at a maximum; greater production of glycerin as a coproduct of fatty acids and fatty alcohols. Net imports were also higher.

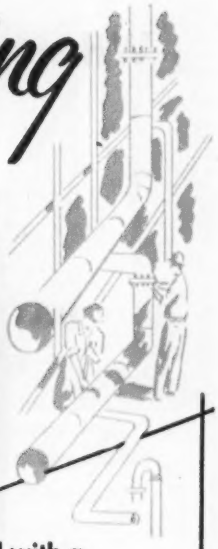
Chemical Profits Light Up the Sky

Glowing sales and profits pictures are causing most chemical companies to look back on 1953 as the best year ever. And the outlook for this year is for more of the same.

The American chemical industry sold over $20 billion worth of products last year—a jump of 10 percent over 1952—according to a survey by the Manufacturing Chemists' Association. Pre-tax

Process Piping





...produced with a combination of engineering guidance and manufacturing skill.

The engineering guidance manifests itself chiefly in two ways: (1) in designing the layout and in selecting materials and sizes to fit the processing problem when such cooperative help is desired by the purchaser; or (2) in double-checking specifications. Both of these engineering services are backed by broad knowledge of processing and an appreciation of how process piping is suppose to function and what is needed to resist corrosion, pressure and temperature; also how to handle best the inevitable expansion when a cold-hot cycle is in the operation.

The manufacturing skill comes from highly experienced craftsmen who have spent many years in fabricating process piping, utilizing over the years *all* the commercially used stainless and non-ferrous materials and knowing how to work with them.

Engineering and Manufacturing

Process Equipment of Our Design to Solve Your Problems

We'll be glad to help design your process piping layout or quote on your own design and specifications.

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WHATEVER YOU PROCESS . . .
FROM PLASTICS TO PHARMACEUTICALS, YOU CAN RELY ON READ STANDARD MIXERS FOR TOP LEVEL DEPENDABILITY
Heavy Duty Double-Arm Mixers in tilting and stationary bowl models . . . for atmospheric, reduced, or elevated pressures . . . with single, multiple, or variable-speed drives and temperature controlling jackets . . . overlapping mixing arms . . . sigma and other type mixing arms . . . working capacities one quart to 1500 gallons. • Laboratory Mixers for the most exacting types of laboratory mixing . . . built in working capacities of one, three, six and 20 quarts. • Vertical Mixers, planetary action for processing of dry materials, creams, emulsions, and light plastic masses . . . a complete line with multiple beater speeds and designed to accommodate several sizes of bowls . . . many auxiliary attachments available . . . 12 to 175 quarts. • Spiral Ribbon Mixers for continuous or batch blending and mixing of pulverized, granular dry or wet materials . . . operation under pressure or full vacuum . . . with or without temperature controlling jackets . . . working capacities one to 500 cubic feet.
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CHEMICAL DIVISION:
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ECONOMICS . . .

profits are estimated at $2.5 billion; net income was over $1.1 billion.

Compared with other U. S. industries, this is a tremendous showing . The chemical industry earned about 14 percent on sales before taxes, contrasted to about 9 percent for 23 other industrial groups.

Here's a rundown on how some of the chemical process companies did in 1953:

	Net Profit (Thousands) 1953	1952	Percent Gain
Air Reduction	$6,766	$7,290	—7.2
Allied Chem. & Dye	45,172	40,305	12.1
American Cyanamid	27,473	26,612	3.2
Atlas Powder	2,231	2,022	10.3
Celanese	10,653	9,214	15.6
Commercial Solvents	2,656	1,368	94.2
Diamond Alkali	5,939	5,462	8.7
Du Pont	235,978	224,065	5.3
Firestone	46,749	43,082	8.5
Hercules Powder	11,681	11,218	4.1
Hooker[1]	3,378	3,031	11.4
International Min.[2]	7,527	6,671	12.8
Koppers	9,026	8,613	4.8
Libbey-Owens-Ford	19,234	14,908	29.0
Lion Oil	10,688	10,211	4.7
Mathieson	18,756	13,553[3]	38.4
Monsanto	26,385	23,189	13.8
Pennsalt	3,107	3,218	—3.4
Pfizer	14,160	11,362	24.6
Ruberoid	4,576	4,046	13.1
Spencer[2]	5,044	4,467	12.9
St. Regis Paper	16,157	12,702	27.2
Sun Oil	45,154	43,013	5.0
Union Carbide	102,783	98,321	4.5
Vick	3,395	2,055	65.2

[1] Fiscal year ends Nov. 30.
[2] Fiscal year ends June 30.
[3] Includes figures for Squibb.

Look for More Normal Inventories by Midyear

More than 50 percent of American industry is now reporting a drop in inventories. The liquidation follows a normal paring down procedure. Scarcely any dumping is found.

But business has not had an easy time of it, especially durable goods. Major reason is that sales have slipped more rapidly than inventories. In hard good lines, new orders are down 25 percent. Inventories, which were twice as high as incoming orders a year ago, are now three times as much.

Chances are, though, that the ratio of inventories to sales will begin to recede. An upturn of new orders is reported throughout the nation.

When inventories hit their latest peak of $82 billion last September, they were about $4 billion above the level which experience indicated would be comfortable for the volume of business being conducted. Most guesses at that time were that it would take the better

part of a year for them to run off to a normal level. In the meantime, of course, production would be cut back to the extent that consumption was fed out of inventories.

But the recovery seems to have gone much faster than was generally anticipated. The level dropped about $1 billion in the last quarter of 1953. And it's still going down fast, perhaps as much as $1.5 billion in the first quarter of 1954.

If, as now seems possible, the process of getting inventories back to normal is completed by midyear, it could result in an upturn in consumer incomes and expenditures much sooner than it has seemed reasonable to anticipate. And if a decline in investment doesn't occur—also a likely assumption—this upturn in consumer expenditures could well reverse the downward drift of business generally.

Neoprene Consumption Sets New Record

An all-time high in the usage of neoprene was reached in 1953—more than 15 percent above 1952—according to Du Pont. Generally favorable growth is forecast for this year.

And Du Pont is expanding to meet further expected demand increases, will have a third more capacity by 1956 than it has today.

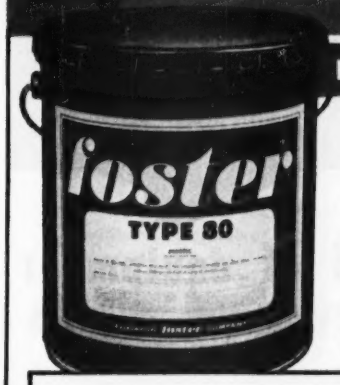
Avgas Output Jumps 11.8 Percent in '53

Latest Bureau of Mines figures show big increases in the production and sale of aviation gasoline. Production rose from 80,350,000 bbl. in 1952 to 89,813,000 bbl. last year—up 11.8 percent. Total demand increased from 76,994,000 bbl. to 86,596,000 bbl.—a rise of 12.5 percent.

But stocks rose, too. Year-end reports from 1953 showed nearly 5.5 million bbl. of 100 octane or higher gasoline in storage, plus 4.7 million bbl. of other aviation grades. Comparable figures for 1952 were 4.85 and 4.4 million, respectively.

FIRST

and the Only One!



FOSTER'S TYPE 80 MASTIC

the first and only Mastic with the UNDERWRITERS' LABORATORIES *label classification: as to* FLAME SPREAD • FUEL CONTRIBUTION *and* SMOKE DEVELOPED

Safety Engineers. Chemical Engineers. Plant Maintenance Superintendents. Architects and many other top-flight executives have wanted this: a Mastic that gave complete protection against corrosion, rust and weathering

Plus

providing a dependable moisture vapor barrier

Plus

an UNDERWRITERS' LABORATORIES listing of classification...

and here it is!

FOSTER'S TYPE 80 MASTIC

There's plenty more to be said about the outstanding features of this Fire-Resistive TYPE 80 MASTIC... all yours, for the asking.

Contact our nearest representative (we have National Representation) or write to our Manufacturing and General Offices.

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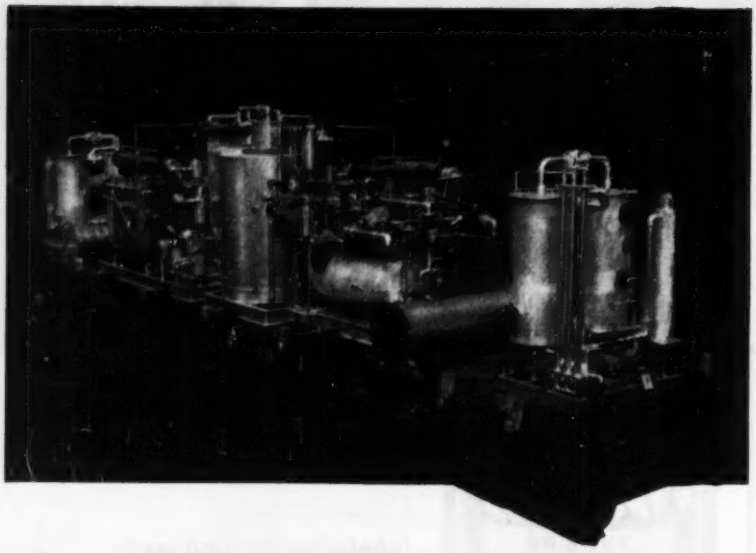
if you use GAS --

for protective atmosphere



this single carload of equipment could save you $1.00 every two minutes

For concerns using any amount of gas sizable savings are possible simply by taking advantage of modern gas generation equipment. The customer's own figures prove that frequently these savings, in a single year, amount to more than the entire cost of the equipment.

For example, this recent shipment of gas generators and dryers went to a leading aircraft manufacturer who used nitrogen gas in his parts annealing. He formerly purchased his gas in cylinders at a cost of about $6.00 per 1000 cubic feet. These units tested out at 3000 cubic feet per hour each — producing the gas for as little as 18 cents per 1000 cubic feet. This amounted to a savings of approximately $5.82 per 1000 feet about $34.92 per hour, or 58 cents per minute.

Check your gas costs, and if you haven't looked into gas generation equipment it will pay you to do so as soon as possible. And when you do, keep in mind that Gas Atmospheres' high efficiency generators remain unsurpassed when it comes to product quality, high production and low costs.

Whatever it is in industrial gas—look first to Gas Atmospheres. Literature currently available on Reducing, Nitrogen, Inert and Carbon Dioxide generators.

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equipment for producing industrial gases

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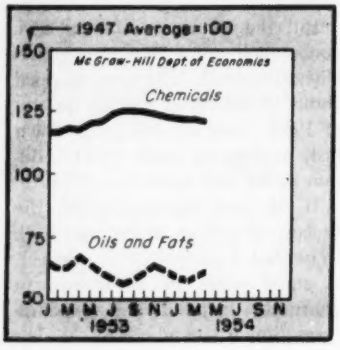
THIS MONTH'S

Industry

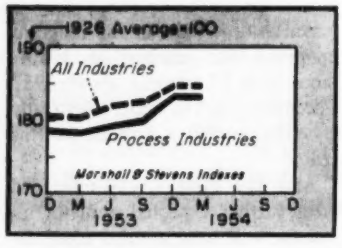
PRICES...



CHEMICAL PRICES.....122.7
OILS & FATS PRICES..... 61.1

As of Apr. 1, 1954	122.74	61.08
Last month	123.57	59.64
1 year ago	118.10	68.17
2 years ago	120.04	56.14

EQUIPMENT COSTS...



ALL INDUSTRY AVERAGE.....184.8
PROCESS INDUSTRY AVERAGE..183.5

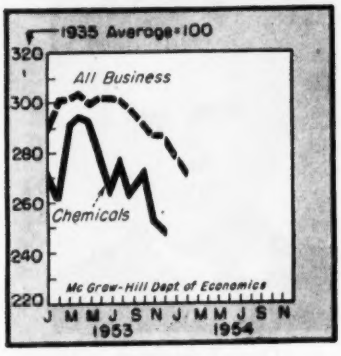
	Dec.	Mar.
Process Industries	**1953**	**1954**
Cement mfg.	177.8	177.8
Chemical	186.4	186.4
Clay products	172.6	172.6
Glass mfg.	176.2	176.2
Paint mfg.	179.5	179.5
Paper mfg.	179.8	179.8
Petroleum ind.	183.0	183.0
Rubber ind.	185.4	185.4
Related Industries		
Elec. power equip...	188.3	188.3
Mining, milling ...	187.4	187.4
Refrigerating	204.9	205.1
Steam power	175.7	175.7

Compiled quarterly by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. See *Chem-Eng.*, Nov. 1947, pp 124-6 for method of obtaining index numbers; March 1954, pp. 214-5 for annual averages since 1913.

Trends

Douglas Greenwald

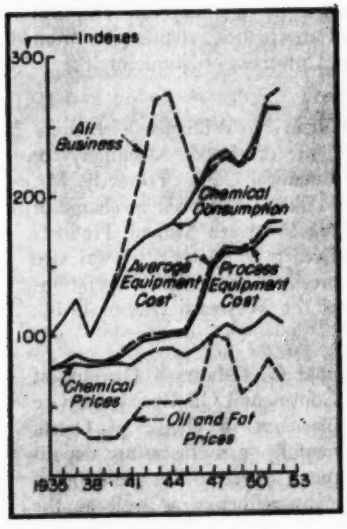
CONSUMPTION . . .

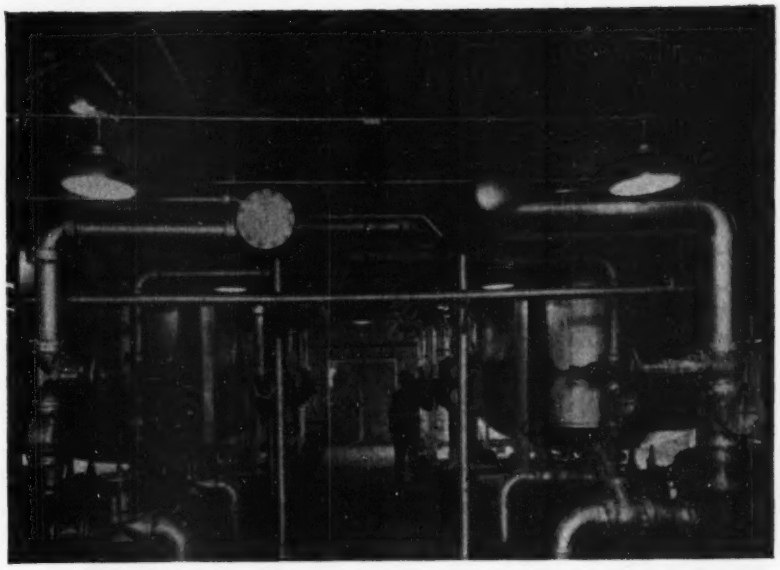


BUSINESS ACTIVITY (Feb.)....271.1
CHEMICAL CONSUMPTION

	Jan. (Prelim.)	Dec. (Rev.)
INDEX	**261.5**	**249.3**
Fertilizer	60.42	56.31
Pulp & paper	30.91	28.37
Petroleum ref.	28.01	28.08
Iron & steel	14.58	14.57
Rayon	23.99	24.65
Glass	22.65	20.47
Paint & varnish	25.19	22.26
Textiles	9.79	9.79
Coal products	11.21	11.41
Leather	3.86	3.70
Explosives	7.67	7.93
Rubber	5.48	5.29
Plastics	17.73	16.46

LONG TERM . . .





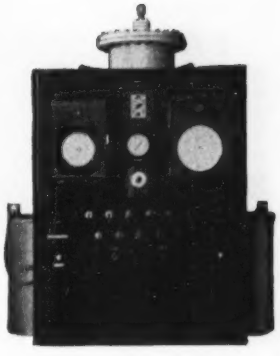
Higher purity water from Cochrane DEMINERALIZERS

For make-up or process, Cochrane Demineralizers deliver a continuous supply of demineralized, silica-free water at remarkably low cost.

Cochrane offers demineralizer designs to meet the most stringent requirements—2-bed, 3-bed, 4-bed or compact mixed bed units manually or automatically controlled. Effluent produced is of a higher electrolyte purity than most distilled waters yet normally costs many times less.

Cochrane engineers and manufactures every type of ion exchange and precipitation type water conditioning equipment which assures you of unbiased recommendations for equipment best suited to your requirements. Its complete service provides single responsibility for engineering, fabrication and continued satisfactory operation.

For further details on Cochrane Demineralizers, write for Pub. 5800.



Mixed bed unit designed for automatic operation. Delivers an effluent with less electrolyte than is possible through any other method.

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Bemis Waterproof LAMINATED-TEXTILE Bags

These are the bags you need for the greatest protection at economical costs . . . *the strongest shipping bags made.* They are 3- or 5-layer construction, with crinkled paper or plastic linings laminated to cotton or burlap.

Bemis Flexiply Bags

If you require a little less than the super-protection of Bemis Waterproof Bags, these laminated, all-crinkled-paper bags are your best bet. Bemis Flexiply Bags are tough—all plies are crinkled to give stretch and flexibility.

Ask your Bemis Man to help you determine which is the practical, economical shipping bag for you. Remember—with either Bemis Waterproof or Bemis Flexiply, you get the benefits of Bemis crisp, bright multi-color printing . . . and Bemis multi-plant service.

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THIS MONTH'S

Names in

Oscar J. Swenson

Technical director for the General Research Organization of Olin Industries, Inc. In 1945, Dr. Swenson joined Olin as a consulting chemical engineer. He became manager of the chemical engineering department of the General Research Organization in 1952. During 1953, he was both manager of the engineering development department and assistant for divisional research.

He came to Olin from Cornell University where he had been a professor of chemical engineering. From 1935 until 1938, he had been an engineer for E. I. du Pont de Nemours & Co.

Dr. Swenson, a native of Roscoe, Minn., holds a bachelor's degree in chemical engineering and has earned his doctorate in chemical and mechanical engineering from the University of Minnesota.

William N. Williams–Vice president of Food Machinery & Chemical Corp. Formerly, Mr. Williams had been in charge of the Westvaco Mineral Products Div.; prior to that, he was vice president in charge of operations of the Westvaco Div. of FMC.

Harold G. Osborn – Director of Continental Oil Co. He is vice president in charge of Continental's manufacturing department, directing the operation of eight refineries as well as the

the News

M. A. Gibbons

development and research, petrochemical and engineering departments.

R. Smith Schenk—Consultant for the White Metal Mfg. Co., Hoboken, N. J. For 29 years, he had been president of Sun Tube Corp. of Canada and headed the firm's branch factory in Mexico. He had been one of the pioneers in advanced methods of manufacturing collapsible tubes.

Benedict F. Melucci—Technical director of the Manufacturers Chemicals Dept., American Cyanamid Co. Previously, Mr. Melucci served with the Falco Metal Products, the Synthetic Organic Chemicals Dept. and the Manufacturers Chemicals Dept. where he was a senior technical representative before his present appointment.

Augustine R. Marusi — President, Borden Co.'s Chemical Div. Mr. Marusi had been vice president in charge of Eastern operations for the division. His association with the firm began 15 years ago at the firm's research laboratory in Bainbridge, N. Y.

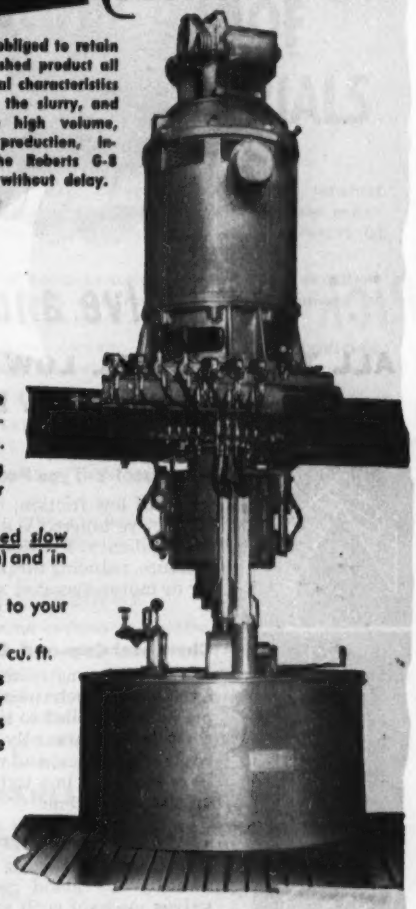
Lawrence W. Bass and **D. Reid Weedon**—Vice presidents of Arthur D. Little, Inc. Until now, Mr. Bass has served the firm as administrator of an industrialization project in Egypt. Previously, he had been a director of research for the Borden Co. Mr. Weedon has been serving the firm in a program of industrialization for Puerto Rico sponsored by the Economic Development Administration of Puerto Rico.

Joseph Boyce—General manager of Vitro Mfg. Co. Mr. Boyce has been with the firm since 1947 as laboratory director, sales manager and, finally, as plant manager. **William B. Hall** has been named general manager of the manufacturing firm's affiliate —

5405

NO LOSS of crystal characteristics DURING CENTRIFUGAL SEPARATION

If you are obliged to retain in your finished product all of the crystal characteristics inherent in the slurry, and yet require high volume, automatic production, investigate the Roberts G-S Centrifugal without delay.



All components of the duty cycle are automatic and interlocked for accurate timing of successive operations.

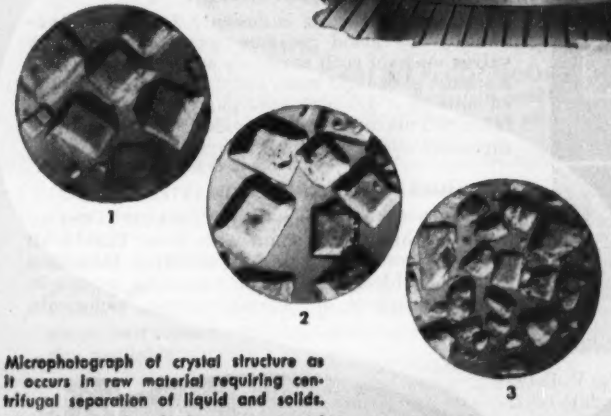
Loading, discharging, and recycling are completely automatic. (Operator acts as an observer only.)

Discharging is accomplished at fixed slow speed (for retention of crystal form) and in reverse rotation (for safety).

All components are fully adjustable to your particular need.

Volumetric capacity of basket is 15.7 cu. ft.

Our new Bulletin No. 5405 provides full information. It's FREE. Write for it! Address The Western States Machine Company, 1700 Fairgrove Avenue, Hamilton, Ohio.



1. Microphotograph of crystal structure as it occurs in raw material requiring centrifugal separation of liquid and solids.
2. Microphotograph of the same crystal structure as it occurs after centrifugal separation of liquids and solids in a suspended type machine featuring fixed slow speed discharging.
3. Microphotograph of the same crystal structure shown at 1 as it occurs after centrifugal separation of liquid and solids in a conventional type centrifugal. Note deformation of crystals due to crushing during high speed discharging operation.

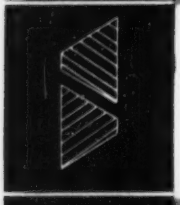
ROBERTS STEVENS
The WESTERN STATES MACHINE COMPANY
HAMILTON, OHIO, U. S. A.

Pick your valve and pump packing

ALL TEFLON . ALL LOW FRICTION LOAD . ALL-CHEMICAL RESISTANT

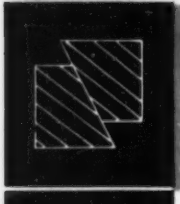
Chemiseal V-Type Packing

Made of low friction, chemically inert TEFLON, its distinctive tapered V design offers greater flexibility and resiliency. Provides necessary seal at low gland pressure, reducing torque required to operate manual, air or motor-operated valves.



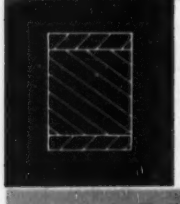
Chemiseal Cup-and-Cone Type Packing

A ruggedly constructed TEFLON Packing for both hand and mechanically-operated valves. When pressure is applied to this cup-and-cone packing, the cones deform inwardly to effect a seal at the spindle, while the cups expand outwardly against the stuffing box—resulting in a tight seal with minimum friction on the valve stem.



Chemiseal Wedge-Type Packing

This TEFLON Packing is designed to offer the unusually low gland pressure required for use in valves made of such materials as ceramics, Haveg, Karbate, glass-lined steel, etc. Offering many of the advantages of soft packings—plus the chemical resistance of TEFLON—it also provides space for thermal expansion and is adaptable to spring loading.



Chemiseal Pump Packing

Made in three types—pure TEFLON, TEFLON with Graphite and TEFLON with Mica. Handle all types of corrosive materials including hazardous chemicals. Ideal for non-contaminating service in the manufacture of pharmaceuticals, biologicals, foods, etc.

● Ask for Bulletin TP-1053.

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NAMES . . .

Vitro Uranium Co. Until recently, he had been vice president and plant manager of the company.

John E. Barkley—Manager of Physics and Chemistry Research for the Mechanical Division of General Mills, Inc. Formerly, he had been head of physical-chemistry research at the Armour Research Foundation. He has been especially active in the field of semi-conductors.

Edward A. Kern—Manager of Engineering for General Electric Co.'s Silicone Products Dept., Waterford, N. Y. Since 1942, Dr. Kern has been manager of the materials and processes laboratory at GE's Transformer Div., Pittsfield, Mass.

Richard A. Badger, Samuel N. Johnson and **Vernon R. Childress**—Respectively, process engineer, alkyd resin plant; project engineer, phenolic products plant; manager, marketing research and product planning for the Chemical Materials Dept., General Electric Co.

John R. Bowman—Director of Research, Mellon Institute's Dept. of Research in Physical Chemistry. The Institute's Dept. of Physical Measurements has also been united with the Dept. of Research. Mr. Bowman has been a member of the executive staff since 1948.

J. Clark Kaskie—Member of the process investigation group of Monsanto Chemical Co.'s engineering dept. Mr. Kaskie, who has been serving as a supervisor at the John F. Queeny plant, will become supervising engineer for product investigation work on polyethylene.

Wallace F. Armstrong—Ass't general manager of manufacturing at Ethyl Corp.'s Baton Rouge, La., plant. He has been plant manager of Ethyl's Houston plant since 1951; in this capacity, he will be succeeded by **Glenn**

O. Hayes. James J. Bergin and **Melvin C. Hudgins** have been appointed to the Houston and Baton Rouge plants, respectively, as assistant managers.

Robert C. Adams—Chairman of the Joint Research Committee on Boiler Feedwater Studies. Mr. Adams, superintendent of the Chemical Engineering Laboratory at the U. S. Naval Engineering Experiment Station, Annapolis, Md., replaces Everett P. Partridge, who has been associated with the Committee since 1925.

EAVESDROPPING

"The progress of genius and inventiveness is something that is always underrated."

Crawford H. Greenewalt*

There has been much speculation as to the reasons for the spectacular advance of our American economy. Some have ascribed it to the size of our continent, some to our raw material resources, some to the strength and vigor of our people. To me the answer is a simple one. It is nothing more than human ingenuity operating in an atmosphere of individual freedom and incentive.

Genius and inventiveness are found among the people of every nation. They are not an American monopoly. But the atmosphere of freedom in which we Americans live and work is unique among nations. It is in itself a creation of man's genius, an experiment born of dissatisfaction with the authority to state, the guilds, a rigid social order, and all of the confining trappings of 18th century Europe. Our experiment in government has succeeded beyond the fondest expectations of its founders for not even they could foresee the effects of man's daring, vision, and creativeness set free to operate without let or hindrance.

*President, E. I. du Pont de Nemours & Co. before the Commonwealth Club of San Francisco.

The ATLAS DIRECTORY of CORROSION PROOF CONSTRUCTION MATERIALS

CORROSION PROOF CEMENTS

ALKOR—A furfural alcohol resin cement which is the nearest approach to a universal corrosion resistant cement. Complete resistance to non-oxidizing acids, alkalies, salts and most solvents at temperatures up to 380° F.

VITROBOND—An economical hot pour sulfur cement having excellent resistance to non-oxidizing acids and moderate concentrations of oxidizing acids such as nitric and chromic.

CARBO-KOREZ—Phenolic base cement resistant to non-oxidizing acids, salts and most organic solvents. Excellent for sulfuric acid.

CORROSION PROOF LININGS

ATLASTAVON—Polyvinyl chloride sheet lining resistant to acids, alkalies and some solvents.

SARAN SHEET—General purpose tank lining with excellent resistant properties.

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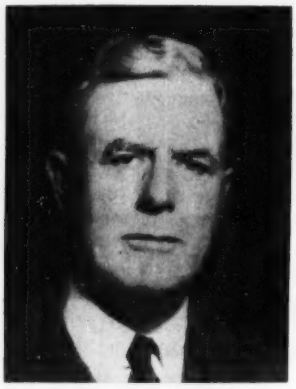
NAMES . . .

R. W. Cretney—Vice president and general manager of the Thermatomic Carbon Co., an affiliate of Commercial Solvents Corp. Mr. Cretney has been with the firm since its founding in 1923. He succeeds **Mr. Clark Boardman,** who has retired after 32 years of service.

N. Eldon Tanner—President of Trans-Canada Pipe Lines Ltd. Mr. Tanner is the former minister of Lands & Minerals in the Alberta provincial government and president of Merill Petroleums Ltd.



Raymond E. Kirk

Recipient of the $1,000 Scientific Apparatus Makers Award in Chemical Education. Dr. Kirk is dean of the graduate school and head of the chemistry department at Polytechnic Institute of Brooklyn.

Dean Kirk, who has been teaching chemistry for 37 years, is recognized for his inspiring lectures, efficient administration and progressive research leadership. He is known for his devotion to teaching, his enthusiasm, and his success in making his courses interesting by dramatizing the subject. It is his belief that both the teacher and the student must "continually reorganize their knowledge and continually rephrase their own generalizations."

Well known in the technical world as co-editor with Dr. Donald F. Othmer, of the Encyclopedia of *Chemical Technology,* Dean Kirk has also been recognized for his re-

search on portland cement, the oxidation of hydrazine and the chemistry of the less common elements.

The chemical education award is given to recognize "outstanding contributions to chemical education considered in its broadest meaning, including the training of professional chemists; the dissemination of reliable information about chemistry to prospective chemists to members of the profession, to students in other fields, and to the general public; and the integration of chemistry into our educational system." The award was established by the association in 1950.

Ernest W. Neben—Manager of Pfaudler Co.'s chemical equipment div. As an engineer for the M. W. Kellogg Co., he previously worked on high temperatures and high pressure problems for the petroleum and petrochemical industries. Immediately, before his present appointment, Mr. Neben had been chief process engineer for Pfaudler.

Reginald E. Dugart—Senior chemical engineer in the technical service division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. In this position, he will be concerned with economic studies related to product quality improvement.

Robert D. Dietert—Staff member of the production department of Monsanto Chemical Co.'s Texas City, Tex., refinery. Mr. Dietert received a B.S. degree in chemical engineering from Texas A&M College.

S. C. Rothmann—Director of the City of Philadelphia's Div. of Air Pollution Control. Formerly industrial hygiene engineer at the University of California at Los Angeles, where he was responsible for the engineering control of atmospheric contaminants.

Wilburn T. Askew—General manager of Sun Oil Cod's refinery at

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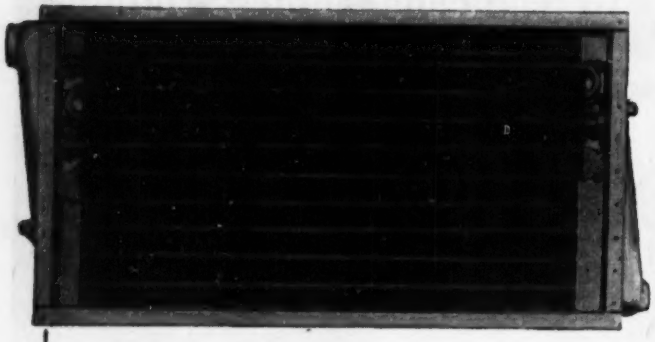

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NAMES . . .

Marcus Hook, Pa. Mr. Askew joined the firm in 1931 immediately after graduation from Texas A&M. He succeeds **Charles E. Maschal** who died suddenly on February 17.

EVESDROPPING

"Europe cannot ever become prosperous through exports alone."

Cary R. Wagner

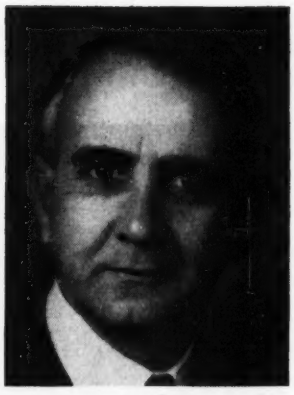
Without thinking the problem through, many well-meaning Americans are saying that we should drastically reduce, or abolish our tariffs. "Trade, Not Aid" has become their slogan. They contend that by importing more we will help European workers earn more, in which case those people would be less susceptible to Communism.

Suppose we do open our chemical market to our European competitors. Would this help the European chemical worker? I doubt it. What would help European workers most would be for European industry to raise its employees' standard of living, just as we have done in this country.

Europe cannot ever become prosperous through exports alone. Prosperity there must come through raising the standard of living of the European people so that Europe could become a mass market for all the things that Europe is capable of producing. It is a cruel deception to contend that widespread unemployment in America due to cheap imports will put more money into the European worker's pay envelope. It won't.

As long as these extremes in living standards exist here and abroad, our domestic organic chemical industry needs tariff protection. Without that tariff the ultimate effect would be to force us to make a painful choice between shutting down many of our plants, thereby wiping out thousands of jobs now and for the future, or of reducing wages, curtailing our 200 million dollar per year research program, and our multi-million dollar expansion plans.

In short, we would be right back where we were thirty-five years ago.



Alexis Voorhies, Jr.

Director of the Esso Laboratories at Baton Rouge, La., Mr. Voorhies is the recipient of the Louisiana Engineering Society's Technological Achievement Award for 1953. The annual award is presented to an engineer in the state for distinguished technological advancements or discoveries that contribute to the field of engineering. The selection of Mr. Voorhies for this honor was based on "his continued interest in and contribution to the application of the fluidized technique for solids handling and his interest in the problems and development of technical employees."

A native of New Iberia, Mr. Voorhies is a graduate of Louisiana State University and of Loyola University in New Orleans. He began his career as a sugar engineer and later taught chemistry, physics and mathematics at the Louisana State Normal College and at Loyola. He joined the Esso Laboratories at Baton Rouge in 1930 as an engineer, subsequently serving in various technical and supervisory positions. He was named director of the laboratories in 1947 after serving as associate director for the Esso Laboratories for a number of years.

A widely recognized authority in the engineering phase of petroleum refining processes, he is particularly well known for his work in the fields of hydrogenation, polymerization, fluid catalytic cracking, and fluid coking. He is a member of ACS, Alpha Chi Sigma, and A.I.Ch.E.

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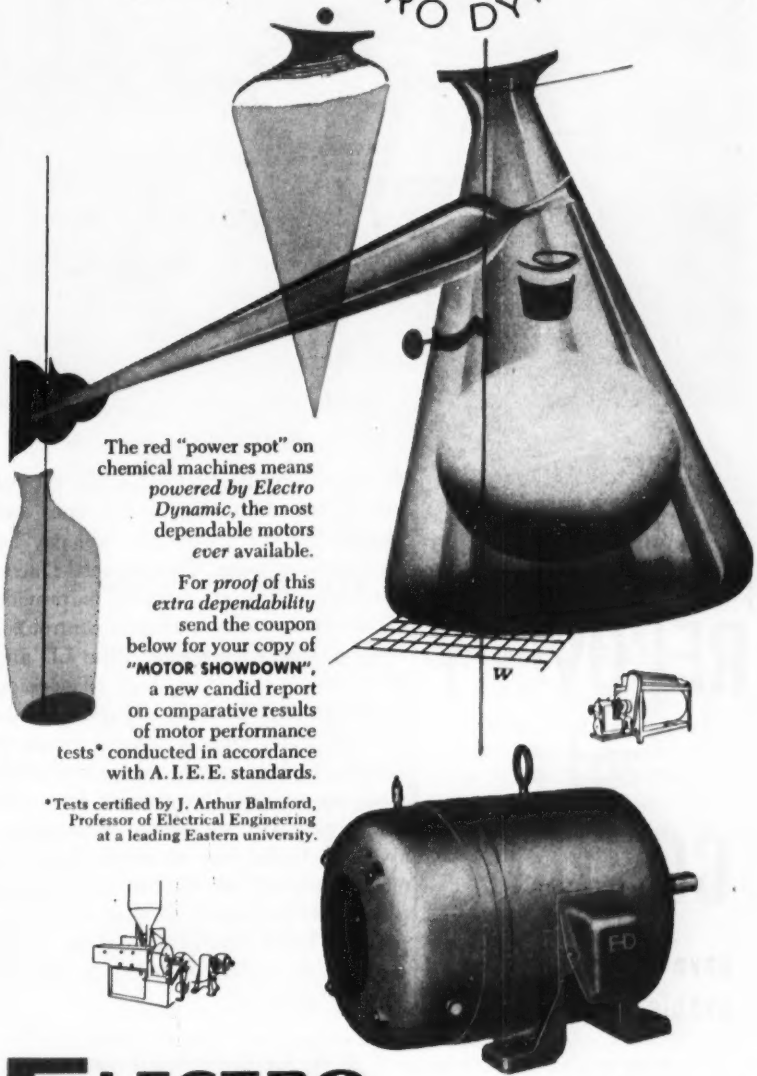

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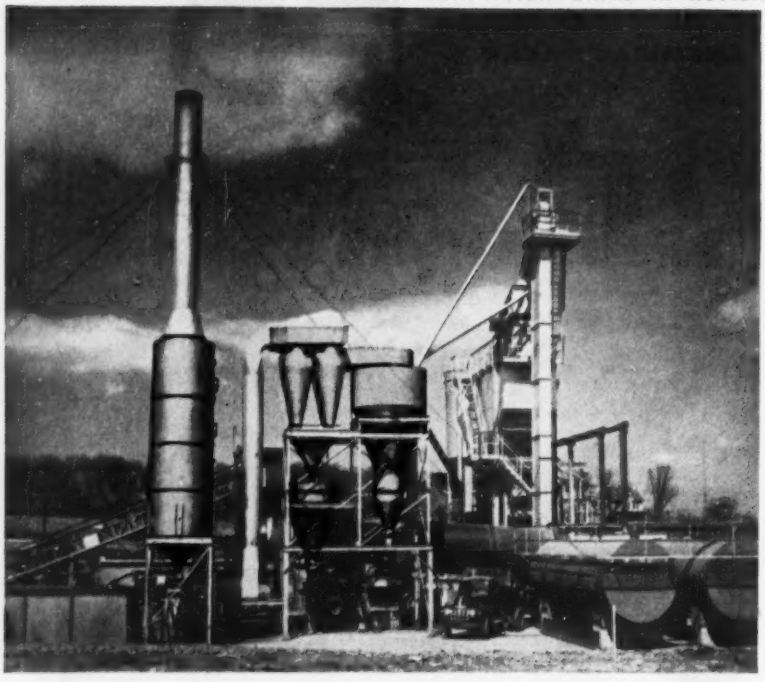

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THIS MONTH'S

Man of

Fabian Bachrach

WILLIAM J. SPARKS

Co-inventor of butyl rubber to receive the 1954 Gold Medal of the American Institute of Chemists this month.

If you were to make a survey to determine the reasons why people chose this or that profession for their life's work you'd come up with a wide variety of motivations—some of them pretty surprising. But you'd listen to quite a few before hearing one similar to that given by the 1954 Gold Medalist of the American Institute of Chemists, Dr. William J. Sparks of Standard Oil Development Co.

Bill Sparks avers that he studied chemistry simply because at the time he was to select his college major he found that he had already piled up more credits in chemistry than in anything else. Not one to let such things go to waste, Bill chose to major in chemistry.

It could hardly have been a happier choice.

For as the AIC points out in the citation accompanying its medal, Dr. Sparks is being honored not for any single achievement, but for an entire lifetime of achievement.

His more-than-a-hundred patents—on subjects ranging from dough-leavening agents to bentonite greases—are eloquent testimony to his years of research activity. And

the Month

H. T. Sharp

when you add to these the strenuous schedule of administrative work and society activities which he carries you find yourself wondering, "How does he do it?"

Well, a tremendous liking for his work and a willingness to spend extra time on it are part of the answer.

When he and Bob Thomas, his collaborator on about a quarter of those hundred or so patents, made their first batch of butyl rubber, they did it on their day off. It was in one of their Saturday morning sessions at the lab—when they and fellow workers would come in and play around with their own ideas—that Sparks and Thomas came up with the first batch of butyl.

Almost immediately Dr. Sparks and the Development Co.'s management saw the commercial possibilities of the product, and, feeling that it could be made on a large scale at low cost, they spent many another Saturday session thrashing out problems of manufacture and discussing possible uses for the new material.

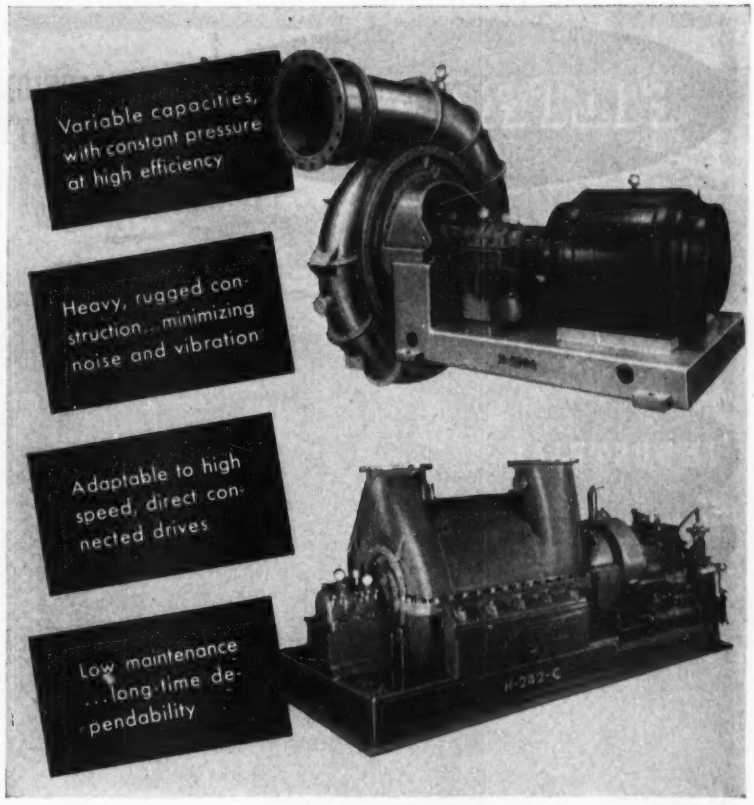
Filled with enthusiasm, they became relentless advocates for its inclusion in the government's synthetic rubber program.

Perhaps it was the training in economics which he received at the University of Illinois (where he minored in economics while taking his Ph. D.*) that helped him see the broad possibilities of butyl.

In any event, throughout his entire career Bill Sparks has consistently combined a remarkable degree of chemical ingenuity with a sound business sense.

His present positions, coordinator of exploratory research for SOD and director of its Chemical Div., give him an excellent opportunity to exploit both this ingenuity and economic common-sense. He now helps judge the long-range commercial feasibility of projected undertakings and consults on the

* Incidentally he also claims that while at Illinois he found time to run the weekly football pool.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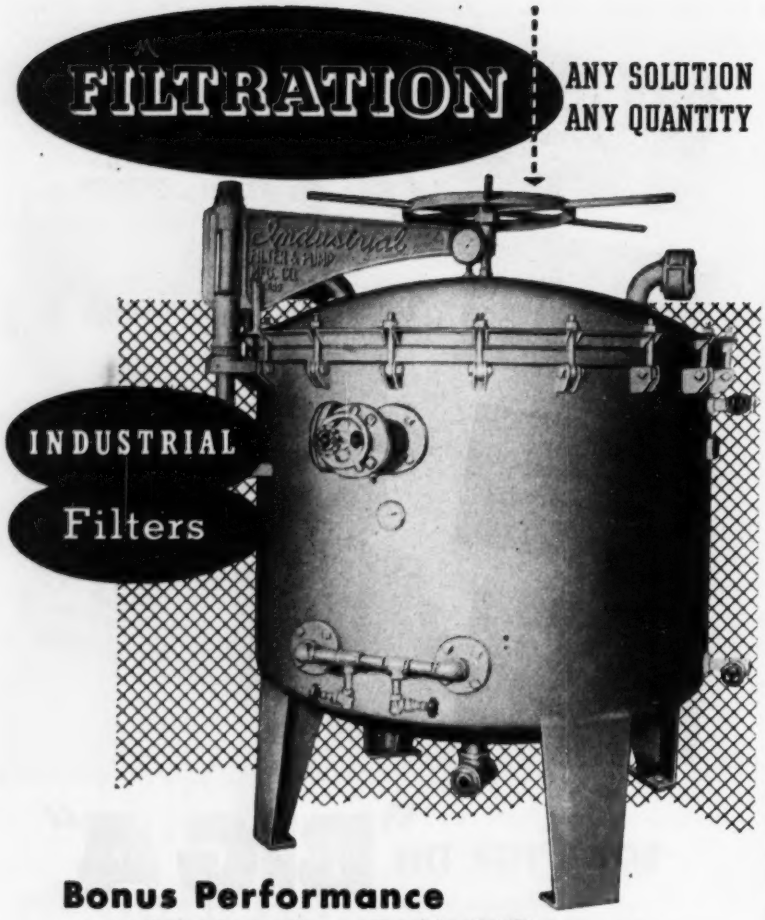

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technical aspects of those projects which have been decided upon.

Bill's broad, start-to-finish interest in a problem is exemplified by his role in the development of butyl. His interest and concern was manifest in everything from the fundamental research to the marketing end. And his advice and counsel were sought by individuals in all phases of the project.

To relax he generally takes to the golf course. A fervent—and pretty fair—golfer, his scores are usually somewhere in the 80's. And friends report that he is also a poker player of no mean stature.

Another source of pleasure and relaxation is his family. He met his wife, the former Meredith Pleasant—herself a Ph. D. in chemistry—while taking his doctorate at the University of Illinois. Their Westfield, N. J., home now echoes the chatter of their four children —two girls, two boys.

However, he really doesn't find as much time for golf and home as he would like. For while he claims that lately he's been more or less easing off his society activities, nonetheless they still take up a sizable portion of his time. At present, Dr. Sparks is serving as chairman of the division of chemistry and chemical technology of the National Research Council.

In addition, he is still active in the American Institute of Chemists and in the ACS.

At present, SOD's Chemical Div. is up to its ears in the development of a new product—an offshoot of the work which he and Bob Thomas

Bob Thomas and Bill Sparks discuss the properties of a new plastic.

did on butyl. And somehow, Bill finds time to follow the details of this work. The new material is a thermoplastic, film-forming copolymer of isobutylene and styrene, known currently as Parapol S. Two batches have already been test-marketed and have received a very enthusiastic reception.

Thus it looks as if the AIC award in honor of past achievements will only serve to spur this eminent scientist on to even greater heights.

William A. Show, William Martin Lumb, Jr. and **Norman J. Wilkaitis**—Chief, dynamite section; chemical engineer; and physicist, respectively, for the Explosives Div., Olin Industries, Inc. Mr. Show comes to Olin from the Army Chemical Center, Md.

William D. Thomas—Member of the staff of Southwest Research Institute. An authority on chemical addition agents for petroleum products, Mr. Thomas will serve as fuels and lubricants technologist for the chemical engineering department. Mr. Thomas had been associated with the industrial research laboratories of American Cyanamid Co.

Allison Maggiolo—Director of development, Ozone Processes Div., Welsbach Corp. Dr. Maggiolo comes to Welsbach from Monsanto Chemical Co., Everett, Mass., where he has been concerned primarily with research and development in organic chemicals.

John H. Bahlburg—Manager, new products, organic chemicals dept., Wyandotte Chemicals Corp., Michigan Alkali Div. Prior to his association with Wyandotte, Mr. Bahlburg worked as a research chemist for H. Kohnstamm & Co.

H. A. Persyn and **T. E. Courtney**—Supt. of the fine chemicals plant and head of the new synthetic pyridine plant, respectively, for the Reilly Tar & Chemical Corp. Dr. Persyn joined Reilly in 1936 and was formerly superintendent

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NAMES . . .

of Reilly's Newark, N. J., plant. More recently, he was in charge of the Indianapolis refinery.

Jack H. Anderson—Field application engineer, Specialized Instruments Corp., Belmont, Calif. Mr. Anderson will cover eastern U. S. in connection with Spinco ultracentrifugal and electrophoresis apparatus. Previously, Mr. Anderson was head of the technical department of Ivan Sorvall, Inc.

James H. Gardner—Ass't Director of the Petrochemicals Dept., National Research Corp., Cambridge, Mass. Prior to his first association with the firm in 1951, he served as a technologist for Shell Oil Co.'s Houston refinery.

Gerald C. Bassler—Joined the chemistry staff of Stanford Research Institute, Palo Alto, Calif. This senior organic chemist will work on air pollution problems for the Air Research Section. Formerly, he was a senior fellow at the Mellon Institute, Pittsburgh.

E. William Eipper—Joined the Market Research & Development Dept. of Stauffer Chemical Co. and associated companies. He will be responsible to **Paul Brallier**, Director of the department. Mr. Eipper was formerly associated with the Oronite Chemical Div. of Standard Oil Co., California.

T. C. Gerber—Administrative director of the General Research organization, Olin Industries, Inc. When he joined Olin in 1952, Mr. Gerber served as resident manager of the Wabash River Div., Liberty Powder Co., Newport, Ind., an Olin subsidiary.

H. A. Bruson—Technical advisor to the vice president of the General Research organization, Olin Industries, Inc. Dr. Bruson came to Olin in 1952 as manager of chemical research from the In-

dustrial Rayon Co. where he has been manager of polymer research for 4 years.

S. R. Pearson—Research and development engineer in the organic research dept. of Dow Chemical Co.'s Texas Div., Freeport, Tex. Mr. Pearson received a B.S. in chemical engineering from the University of Oklahoma.

OBITUARIES

F. F. Bishop, 55, professor of chemical engineering at the A & M College of Texas, died March 6. He had been at the College since 1923. His technical interest and publication were in the fields of vegetable oils and cellulose technology.

George W. Shaffer, 46, plant and field superintendent, S. P. Kinney Engineers, Inc. Mr. Shaffer had been with the firm for the past 5 years. Previously, he had been associated with the Mesta Machine Co., Homestead, Pa.

Charles E. Maschal, 47, manager of Sun Oil Co.'s Marcus Hook refinery, died Feb. 17. Mr. Maschal joined Sun Oil as a still fireman at the refinery and, following a series of advancements, was appointed manager in 1951.

Paul Abbe, 74, president of Paul O. Abbe, Inc., Little Falls, N. J., died after a long illness. Since his establishment of the grinding and mixing equipment manufacturing firm, he pioneered in the introduction of continuous feed and discharge pebble mills in the cement industry.

Charles Lathrop Parsons, 86, a former chief chemist of the U. S. Bureau of Mines and secretary of the American Chemical Society died Feb. 13, at Pocasset, Mass. Of major significance was his work on nitrogen fixation and the conversion of ammonia to nitric acid for use in making explosives, dyes and other products.

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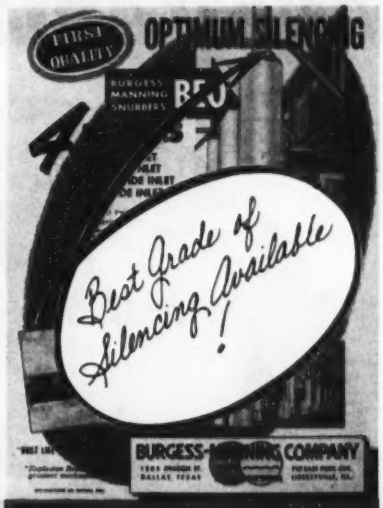

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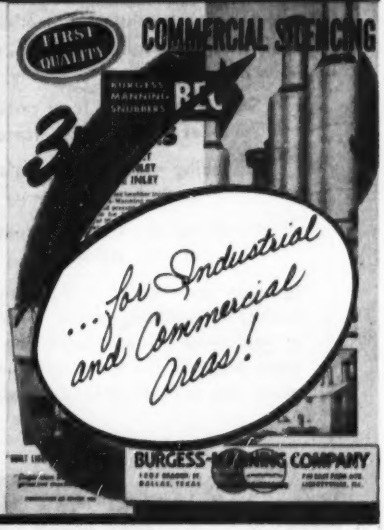


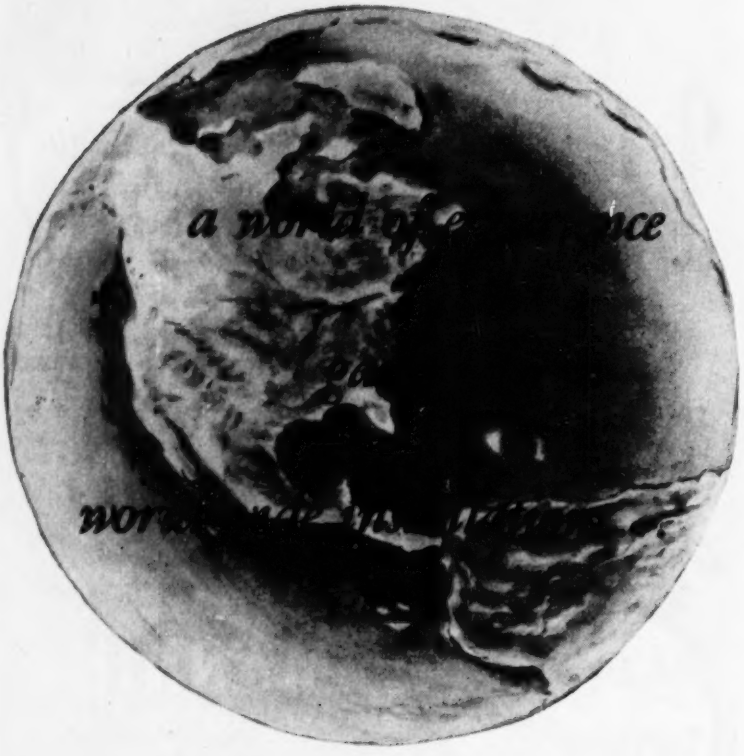
BURGESS-MANNING COMPANY

1203 DRAGON STREET
DALLAS, TEXAS

Sound Engineering

LIBERTYVILLE, ILL
CHICAGO, ILL

AVAILABLE



for any gas scrubbing, cooling or absorption problem...

Peabody installations in Alaska, Canada, Mexico, Venezuela, Brazil, Chili, Peru, Japan, Argentina, Colombia, Union of South Africa, Belgian Congo, England, Holland, France, Spain, Italy and throughout the United States include:

Scrubbing tail gas from carbon black plants,
—at 97% to 98% efficiency—

Scrubbing vented gas from rotary lime kilns,
—at 98% efficiency—

Scrubbing gas from ore roasting operations,
—at 99% efficiency—

In many cases where *cool* gases are required for process work, the *cooling and cleaning can be handled simultaneously by the same piece of equipment* without sacrificing scrubbing efficiency and with low water usage. If you have a problem of scrubbing, cooling, or absorbing gases, look to Peabody for a job-engineered solution.

For descriptive literature, write for Bulletin 203B

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 36, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

OFFICES IN PRINCIPAL CITIES
PEABODY LIMITED • LONDON, S.W. 15, ENGLAND

319-1

THIS MONTH'S

Letters:

Can't Wait Till September

SIR:

As a regular reader of your magazine, I was naturally interested in the unusual (and unusually interesting) ad on p. 298-299 of your March issue entitled "I just can't wait till September!"

These were the pages in which you make the first announcement of CE's new "Annual Inventory Issue" coming up this fall. But I have a couple of questions to ask, both piqued by that "teaser" ad:

What will be the editorial contents and nature of this new Inventory Issue . . .?

Did I recognize Marilyn Monroe on that half-concealed calendar . . . or am I just a wishful thinker?

JAMES R. McDONOUGH
Chemical Engineer
Charleston, W. Va.

▶ *We didn't tell much about the contents of our Inventory Issue partly to tease you and pique your interest, partly because we're telling you about them in follow-up ads each month* (see p. 94-5, *this issue*).

Our only comment on that Marilyn Monroe-type calendar: No further comment.—ED.

Pro & Con

Coming: Mixing Special

SIR:

Since I became a subscriber to *Chemical Engineering* two years ago, I've noticed that each year you have a special issue on some broad engineering subject.

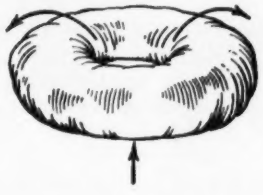
Last year, for instance, it was a special symposium and chart on Heat Technology; in 1952 it was an excellent report and wall chart on Process Instrumentation . . . These issues are extremely valuable to the practical chemical engineer in industry or industrial consulting work.

Is this a regular practice of yours to have one such special issue each year? If so, when will it appear this year?

ROBERT W. DUKE
Development Engineer
Wilmington, Del.

▶ *Yes, it's a practice of ours to have a special issue each June on some unit operation or basic engineering topic.*

This June's report will be on Mixing —a comprehensive but down-to-earth roundup on the practical aspects of mixing as a unit opration. It'll cover both batch and continuous mixing of liquids, semi-solids and pastes and as well as solids.—ED.



Smoke-Ring Extractor

SIR:

Several months ago I wrote you a letter commenting on the "leaning-tower-of-Pisa" design for fractionating towers you had reported in your Tomorrow's Technology department.

Now I open my March issue to Tom's Tech (which has fast become one of my favorite sections in CE) and lo and behold, on p. 264 I see that a couple of smart fellows are claiming they can boost efficiencies in liquid-liquid extrac-

For Eye-Level Readings...

AUTO-LITE

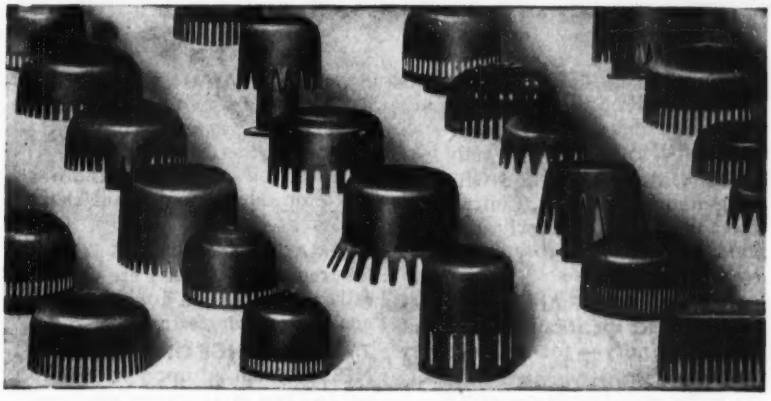
...TEMPERATURE INDICATION

Auto-Lite offers many thermometer styles, permitting plant-wide temperature observation at low cost. Standard temperature ranges from minus 60°F to plus 750°F. Send for latest catalog showing various types.

Model F-1 temperature indicator—Rigid stem or capillary tubing for EYE-LEVEL remote reading. Priced from $22.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE INDICATORS & RECORDERS



SEND FOR PSC

BUBBLE CAP BULLETIN 21

Largest Compilation of Engineering Data.

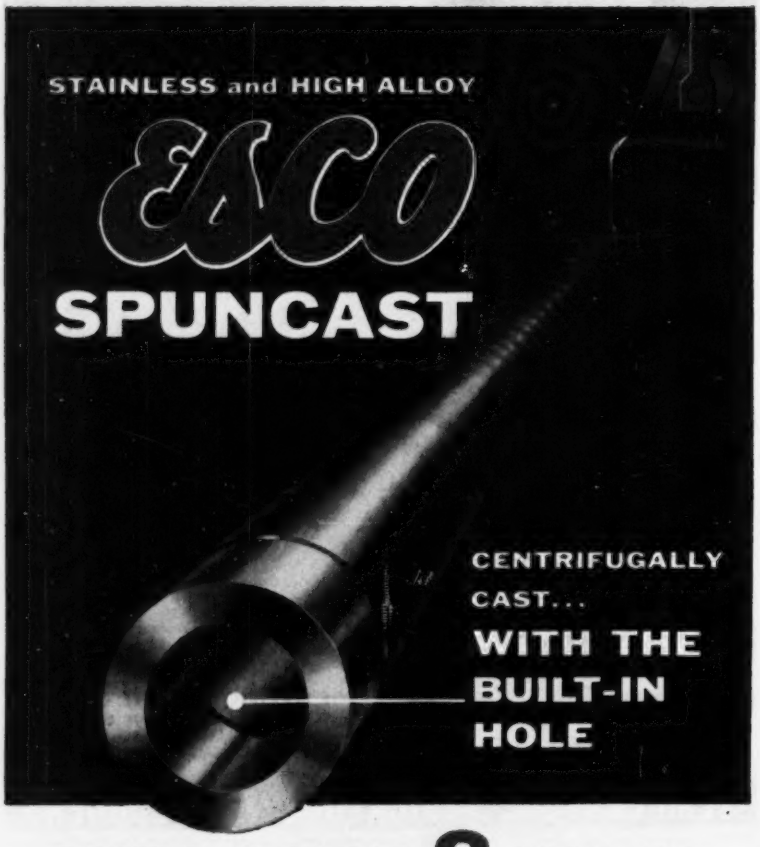
Lists 200 Styles Furnished Without Die Cost.

This standard reference contains complete specification information for over 200 standard styles of bubble caps and risers. Also drawings for use in determining methods of tray assembly. All styles listed in Bulletin 21 are furnished promptly, without die cost, and in any alloy to meet your coking or corrosion problems. Special caps gladly designed; write us to your needs.

THE PRESSED STEEL CO., 707 N. Penna. Ave., Wilkes-Barre, Pa.

PSC

Custom Fabricators for the Process Industries Since 1928. Send Your Blue Prints



CUTS COST 8 WAYS

1) ELIMINATES COST OF BORING BAR STOCK. Spuncast eliminates costly machining involved in producing a tubular shape from a solid bar.

2) MINIMIZES REJECTS with homogeneous structure. Centrifugal force places any light inclusions near inner surface where they are *readily removed.*

3) FLEXIBILITY OF ANALYSIS gives you the exact specifications you want — *economically* — for any quantity you need.

4) WIDE SELECTION OF SIZES . . . through 16" O.D. in basic 72" lengths . . . through 27" O.D. in shorter lengths. Special symmetrical shapes are also available.

5) HEAT TREATMENT TO SPECIFICATION. Hardenable and non-hardenable alloys are readily produced — and can be thermally-treated to provide desired physical, mechanical, corrosion, abrasion-resistant characteristics.

6) SMALLER QUANTITIES (far below regular mill runs) are economically available — in a wide range of analyses or heat treatment.

7) WIDE RANGE OF WALL THICKNESS... from ¼" up.

8) FASTER QUANTITY PRODUCTION... because Spuncast can be supplied in most advantageous lengths to permit machining multiple parts with single set-ups.

This booklet can help you cut costs on hollow, circular or cylindrically shaped products. Send for it today!

ESCO ELECTRIC STEEL FOUNDRY COMPANY
2°62 N. W. 25th Avenue, Portland 10, Oregon

Send me your new booklet
"How to Cut Costs With ESCO Spuncast"

Name_____

Position_____

Company_____

Address_____

Look to ESCO® for Everything You Need in STAINLESS and HIGH ALLOY CASTINGS

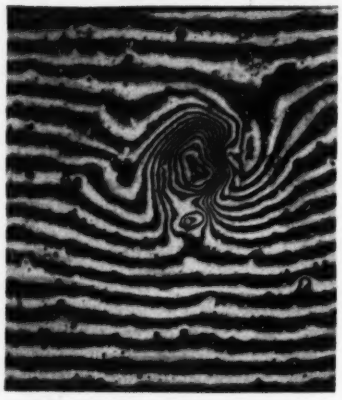
PRO & CON . . .

tion by shooting one liquid through another in the form of vortex "smoke" rings.

I'll modify what I told you several months ago: I'm doubly alarmed at the prospect of sprawling chemical plants studded with Pisa-like towers that blow smoke rings!

HERBERT C. CLAY
Design Engineer
Houston, Tex.

▶ *We'll simply repeat what we said earlier: So are we! But that's "tomorrow's technology" for you.*—ED.



A Flaw in Marilyn?

SIR:

I noticed your "Guided Tour" comment in March in which you say the micro-interferometer can measure surface flaws so small that "Marilyn Monroe would look like one of Macbeth's witches."

Then in the article itself, on p. 217, I was fascinated by that unusual photograph entitled "Finds flaws . . ."

I'd like to ask just one simple question: Which of Marilyn's flaws does that photograph illustrate?

LEONARD HERWOOD
El Segundo, Calif.

▶ *We regret to say that the illustration which fascinated Reader Herward (and which we've reproduced above) is nothing more exciting than a small flaw on the surface of an enamel film. So sorry.*—ED.

Badger's Latest

SIR:

This refers to your February issue containing that excellent arti-

cle on p. 183 entitled "Anhydrous NaOH: Today's Technology" by W. L. Badger and F. C. Standiford. . . .

This certainly was very good reporting of an important case-history application of our Dowtherm material.

We would like very much to have reprints of this article and would appreciate having them sent direct to my attention. . . .

W. D. Boone

Advertising Dept.
Dow Chemical Co.
Midland, Mich.

▶ *Credit for this "good reporting" belongs to that well-known chemical engineer, author and consultant, Walter L. Badger, and to his associate, Ferris Standiford.*—Ed.

Cooling Coils: Coat, No Coat

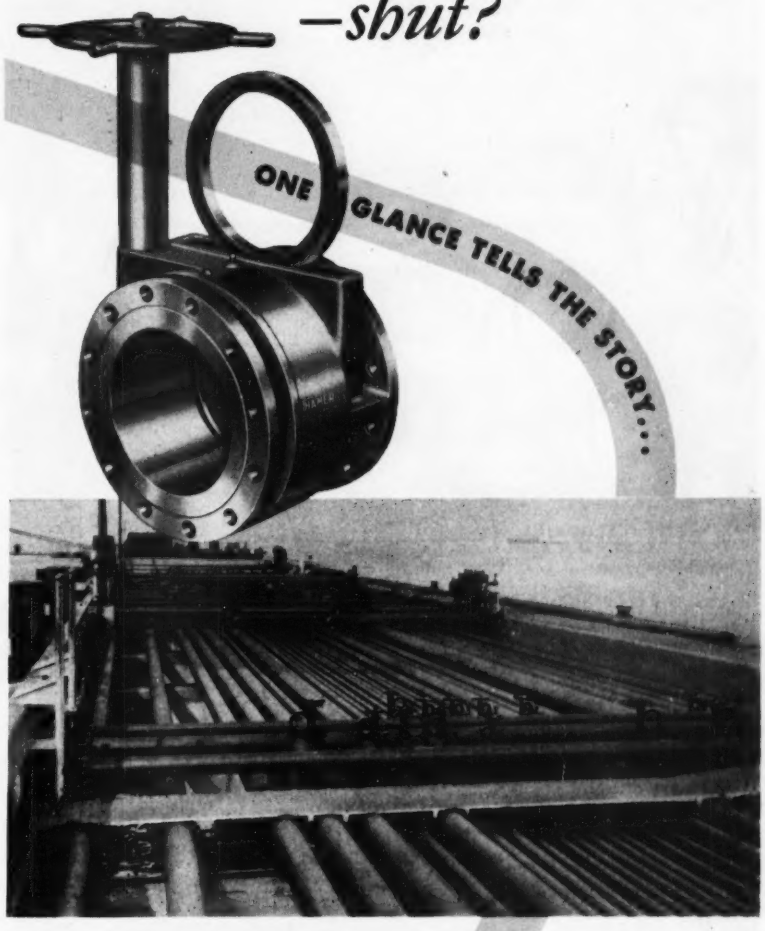
Sir:

I've been told that in one of your recent issues of *Chemical Engineering* you described a new type of aluminizer that can be used to metalize surfaces without heat. This material, I understand, has been used with success on cooling coils to reduce saline corrosion.

Could you please supply more

Lines open?

—shut?



HAMER *Visible Shut-off*

LINE BLIND VALVES

HAMER *Plug Valves*

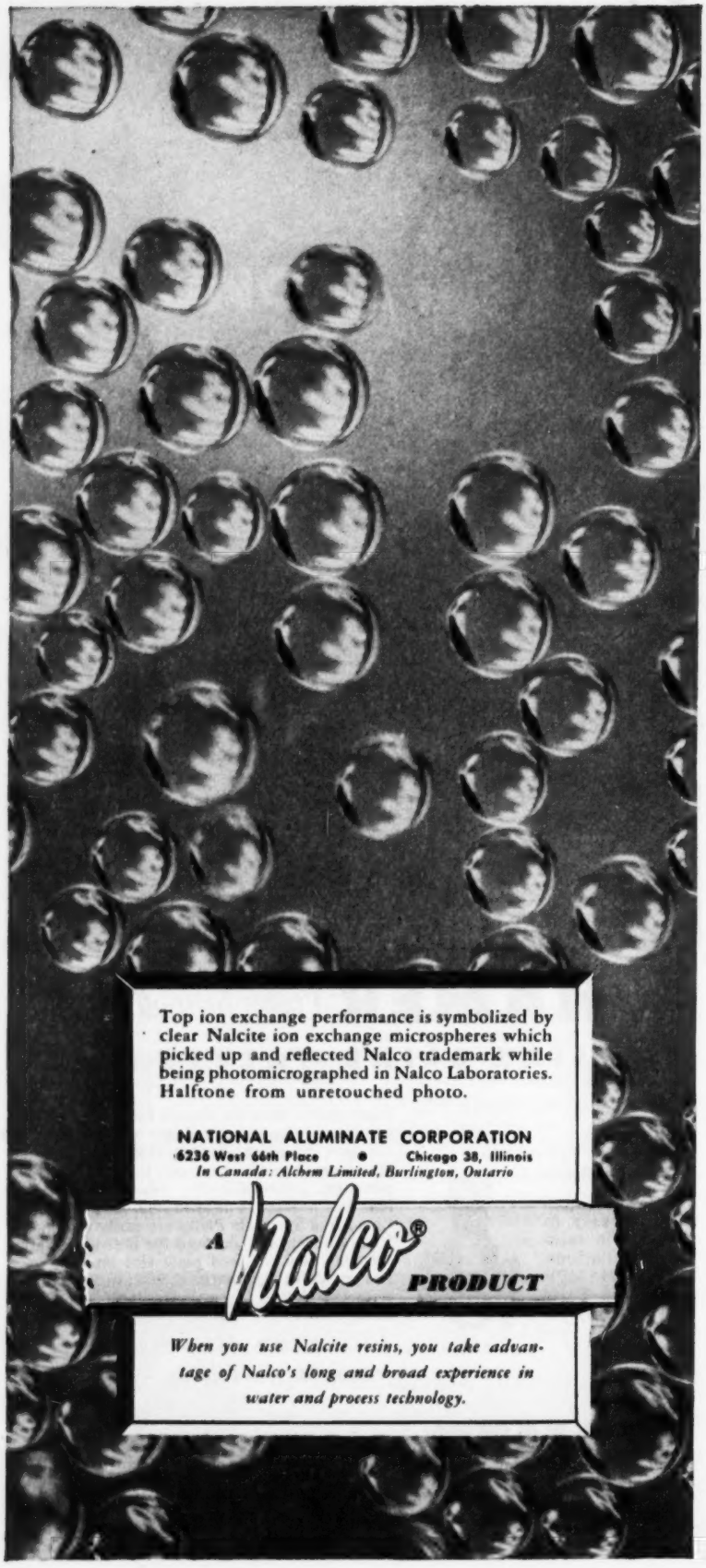
Standard dimensions . . . easy to substitute in existing installations. There's a HAMER *non-stick* Plug Valve for any requirement.

Don't guess—With the Hamer Line Blind Valves you know instantly at a glance which lines are open and which are shut. If the open end of the spectacle plate is up, the line has a **permanent, positive shut-off** . . . blank end up indicates a round, full open line. And Hamer Line Blind Spectacle Plates are easily visible from a distance . . . no need for individual valve checking. An enclosed plate slot on the Hamer Valve eliminates product waste while spectacle plate is being reversed—stops mess, reduces fire hazard.

Send for free catalog.

HAMER OIL TOOL COMPANY

2919 Gardenia Avenue
Long Beach 6, California
Representatives throughout the United States


Top ion exchange performance is symbolized by clear Nalcite ion exchange microspheres which picked up and reflected Nalco trademark while being photomicrographed in Nalco Laboratories. Halftone from unretouched photo.
NATIONAL ALUMINATE CORPORATION
6236 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario
A Nalco® PRODUCT
When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.

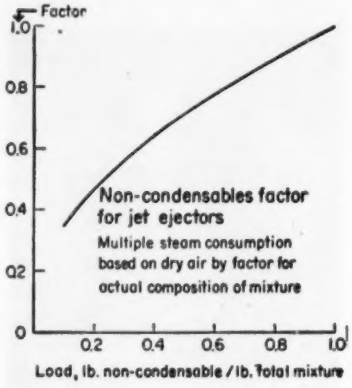
PRO & CON . . .

information on this development . . . for use on the exterior of acid cooling coils?

A. Z. JOHNSON, JR.
Development Engineer
Calgary, Alberta
Canada

▶ *This new plastic-base aluminizer, known as Kolmetal, was described in the Product News section (p. 154) of our February issue. It has been recommended as an exterior coating for acid cooling coils; it has little insulating effect.*

The photograph above compares cooling coils after two years of service in a salt river water with a pH between 4 and 5 (top coils coated, bottom uncoated). For more information contact Enjay Maintenance Engineers, Rutherford, N. J.—ED.



Check Your Jets

SIR:

I have just finished studying Mr. Bohnlofink's very interesting article "How to Check Your Jet Utilities", which appeared in the January issue of *Chemical Engineering* (pp. 161-164).

Incidentally, you might be interested in knowing that the Graham people of Batavia, N. Y., who also make steam jets, issue about as good a simplified manual for calculating jet utility requirements as I have seen. With this and in only a few minutes, one can calculate from scratch the entire requirements using almost any water temperature.

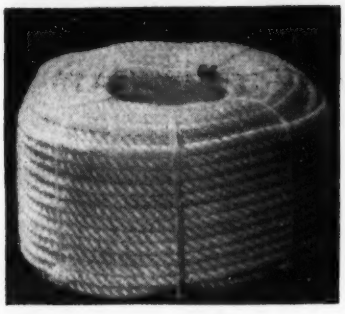
I personally have calculated or specified the requirements for some very large multi-stage ejectors. Frankly, I never fully realized the

impact of the non-condensable factor on the steam requirements as indicated in your Graph 3, on p. 162.

I certainly found this article very interesting, and I am sure it will prove valuable to a great many people.

ARNE R. GUDHEIM
Consulting Engineer
Petersham, Mass.

▶ *Graph 3, referred to by Consultant Gudheim, is reproduced above.—ED.*



Polyethylene Rope

SIR:

We have been informed that a recent issue of your magazine announced a new type of acid-resistant rope made of polyethylene.

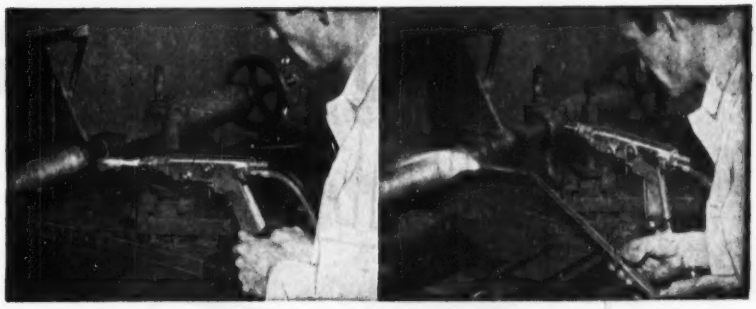
We would appreciate your sending us, as promptly as possible, more information on this development and the company responsible for it. . . .

PETER MORAIS
Johannesburg
S. Africa

▶ *Our announcement (March, p. 144) described this development by U. S. Plastic Rope Co., Inc., of Redwood City, Calif.*

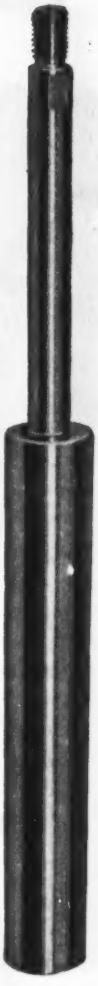
A new process converts polyethylene and Mylar plastic films into rope with the behavior characteristics of natural rope fiber ropes. Yet it is totally unaffected by most acids and alkalis—a unique property that opens up interesting possibilities in the chemical process industries.—ED.

We welcome short, pertinent letters from our readers giving their opinions on developments in the chemical engineering profession and in the chemical process industries. Address the Editor, Chemical Engineering, 330 West 42nd Street, New York 36, N. Y.



First . . . spray the Colmonoy alloy on, Second . . . fuse it to the base metal.

HARD-FACE PUMP PARTS with COLMONOY SPRAYWELDER

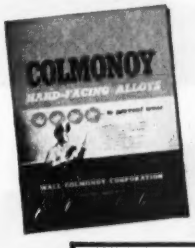


Pump plungers, pistons, rings, bushings . . . any pump or valve part can last longer when hard-faced with the COLMONOY Spraywelder.

The Spraywelder applies powdered COLMONOY alloys which give excellent resistance to corrosion, abrasion, galling, and oxidation. A Sprayweld COLMONOY overlay is smooth, dense, and is **welded** to the part.

Plunger lasts 23 times longer

Plungers in an acid sludge pump were being repacked every 8 hours and replaced every 24. As a trial, worn plungers were reclaimed with the Spraywelder. The process was soon adopted as these needed repacking only every 60 hours, and replacement every 573 hours. Sprayweld cost was half that of a new plunger.



Write us for the name of your nearest shop doing Sprayweld work.

For complete information about COLMONOY alloys and the Sprayweld Process ask for our Hard-Facing Manual No. 77. Engineering Data Sheet No. 3 gives the corrosion resistance of COLMONOY nickel-base alloys. Write today.

HARD-FACING ALLOYS

19345 JOHN R STREET **WALL COLMONOY** DETROIT 3, MICHIGAN
CORPORATION

BRANCHES: BIRMINGHAM • BUFFALO • CHICAGO • HOUSTON
LINDEN • LOS ANGELES • PITTSBURGH • MONTREAL • GREAT BRITAIN

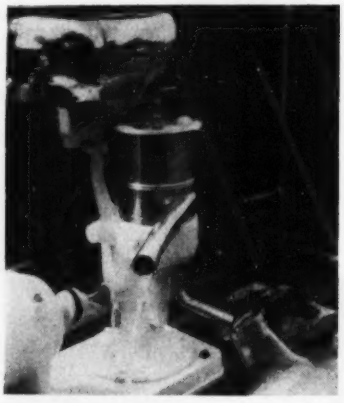
SOLVE YOUR MIXING PROBLEMS

A tremendous variety of fluid mixing needs are ably handled by the complete line of Eastern Mixers. Size and power of mixers are flexible to help solve your problems. For complete information and engineering data, write for Eastern Fluid Mixing Catalogs. Eastern engineers are always available to work out your complex mixing problems with you.

EASTERN INDUSTRIES ★ MIXER DIVISION ★

Eastern INDUSTRIES, INC.
Dept. A, Regent St., Norwalk, Conn.

WHAT'S HAPPENING . . .
(Continued from page 144)



CENTRIFUGE raises solids content of sewage from 0.03 to 0.1-0.3 percent.

New Process Turns Sewage To Cheap Animal Feed

Growing green algae in sewage oxidation ponds can turn ordinary city sewage into low-cost, high-protein animal feed. Pilot plant tests at the University of California's Sanitary Engineering Laboratories, Richmond, Calif., indicate that significant savings in sewage treatment are also possible.

The new process is essentially one of converting most of the organic material in city sewage to algae, then recovering and concentrating the algae by centrifugal separation. As algae manufacture oxygen—an essential element in sewage treatment—they also make use of the abundant nitrogen and phosphate in sewage to grow and multiply.

Thus, since the raw material is practically free, high-protein algae is produced at a much lower cost than by other processes depending on chemically fortified growth cultures.

At the Richmond station, sewage from city sewer tunnels stands in long, open troughs exposed to light in order to encourage green algae growth. Pond temperatures are kept at 40-70 deg. F. for optimum results. And ideally, the pH of the sewage should be 7.5, although it can range from 5 to 10.

In about two days the algae reaches a maximum concentration of about 400 mg./liter–0.03 percent solids–and is sent to a Westfalia LWA-205 centrifuge (made by Merco Centrifugal Co., San Francisco). This model was picked because it can be equipped with four interchangeable bowls to accomplish concentration, liquid clarification, liquid-liquid separation or centrifugal mixing as desired.

The unit, which concentrates the liquor to 0.1-0.3 percent solids, recovers algae at the rate of about 1,000 lb. per million gallons of sewage. This represents a "yield" of 15-20 tons of dry algae per acre per year.

Any harmful bacteria remaining in the concentrated algae are killed by drying and pasteurizing at 200 deg. F. Supernatant liquor from the centrifuge contains only a small residue of unoxidized organic material and is pure enough to be discharged into streams without further treatment.

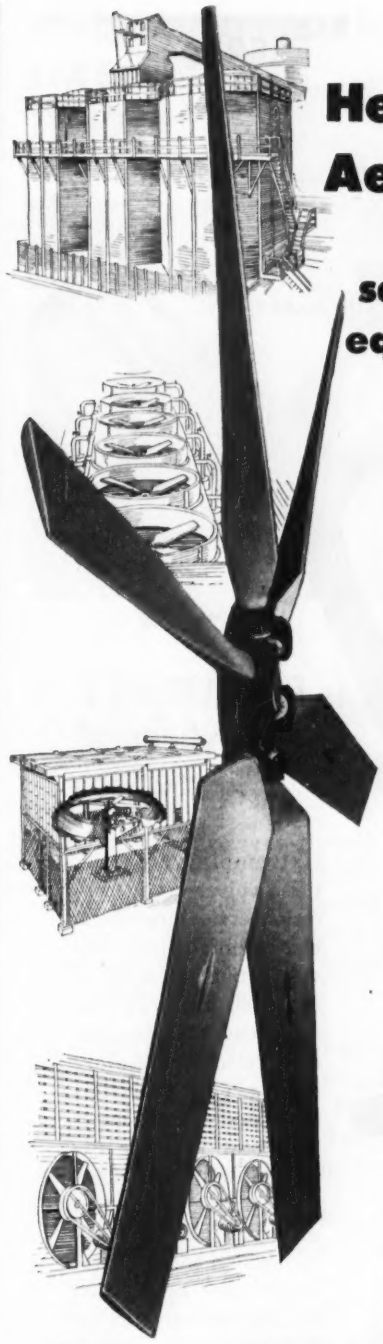
Since the algae contains 50 percent protein, the final product promises to become one of the most nutritious of all available animal feed supplements.

Reichhold Plans Plasticizer Production

As part of its current $10 million expansion program, Reichhold Chemicals, Inc., has decided to enter the plasticizers field. Already a major producer of phthalic anhydride–base of many widely used plasticizers–the company feels that this move will allow better integration of its operations and sales facilities.

So far Reichhold is mum on just what products will be made. But with one eye on the 100 million lb. market predicted by the government for this year one company official has this to say: "In this broad market, we feel that Reichhold's output of plasticizers, offered at competitive prices, will find ready acceptance."

Initial production is scheduled for four plants: Ballardville, Mass.,



Here's Why Aeromaster Fans mean more satisfactory cooling equipment operation

Manufacturers and users of cooling equipment agree... Aeromaster Fans give outstanding service. Here are the reasons why.

Aeromaster Fans are *precision engineered,* adapted from high speed aircraft propellers. They have adjustable blade pitch and anti-flutter design . . . therefore, require less horsepower. And they last longer too, thanks to the exclusive Aeroloid blade coating to resist acids and alkalies, abrasion and weather. Overall result: Aeromaster Fans *give more cooling at lower cost.*

Available in 4, 6, or 8 blade styles, in diameters of 5 to 24 ft., with capacities up to 1,000,000 cubic feet per minute, all Aeromaster Fans are fully guaranteed.

Koppers also has trained engineering specialists available in principal cities, insuring prompt, expert Aeromaster Fan service. And Koppers is always ready to consult with you on special fan problems. Next time you plan a replacement of present fans, specify Aeromaster. And when you consider new equipment, call on Koppers . . . always eager to be of service.

KOPPERS

METAL PRODUCTS DIV. • KOPPERS COMPANY, INC. • BALTIMORE, MD. • This Koppers Division also supplies industry with Fast's Couplings, American Hammered Industrial Piston and Sealing Rings, Koppers Electrostatic Precipitators and Gas Apparatus. *Engineered Products Sold with Service*

Aeromaster Fans

MAIL COUPON TODAY FOR COMPLETE INFORMATION

KOPPERS COMPANY, INC., *Aeromaster Fans,* 235 Scott St., Baltimore 3, Md.
Gentlemen: Please send me detailed information on Aeromaster Fans for

.....
(name and type of equipment to be cooled)

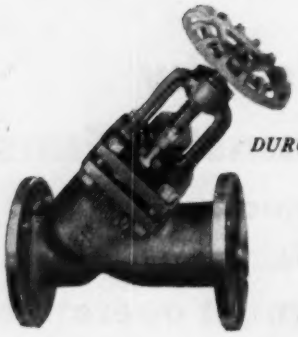
Name .....

Title ..... Company .....

Address .....

City ..... Zone ..... State .....

DURCO



DURCO Type J2 Y Valve

DURCO Type K2 Y Valve

Y is for VARIETY in chemical service

Extremely versatile, these valves are in corrosion service throughout the chemical industry where tight shut-off is required. Type J2 features renewable disc ring and Teflon® -to-alloy seating. Type K2 is similar in design with renewable seat ring for extended life. Design permits varied combination of materials and easy conversion to 90 degree angle valve by rotation of body halves. Write for bulletin V/7.

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON COMPANY, Inc., Dept. CE, Dayton, Ohio

Please send Bulletin V/7.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

Elizabeth, N. J., Detroit, Mich., and Azusa, Calif.

In addition to this move, the company has announced plans for construction of a large phthalic anhydride plant in Elizabeth, N. J., plus expansion of its maleic anhydride plant at the same location. These expansions will boost Reichhold's annual production of phthalic anhydride to 80,000,000 lb., of maleic to 10,000,000 lb.

Chemical Progress Week Planned for May 17–22

In a determined effort to bring home the impact of chemistry on the individual American, members of the Manufacturing Chemists Assn. have organized the first annual Chemical Progress Week for May 17-22. Many companies have been active in this field for years, says MCA president William C. Foster, but never before has the industry banded together for this purpose.

Although the MCA board will act as the national sponsoring committee, prime responsibility for action rests with individual chemical plants in more than 5,000 towns. Where two or more plants exist in a locality, plant management is being asked to form a community committee to plan plant tours and open houses.

On the national scale, radio and television broadcasts in at least 19 major chemical centers will tell the industry's story.

Big New Source of Methyl Mercaptan

Construction of the first multimillion pound synthetic methyl mercaptan plant has begun at Pan American Refining Corp.'s chemicals plant near Texas City, Tex. Operations are expected to begin during the last quarter of this year and full production–five million lb. per year–is scheduled for Jan. 1, 1955.

Pan American will use its own process to convert hydrogen sulfide and methanol to methyl mer-

captan. Provisions are also being made for the production of other mercaptans, such as ethyl and propyl. Raw materials will be produced partly in the company's adjacent Texas City refinery, with the balance being purchased. Rust Engineering Co., Pittsburgh, Pa., is handling the construction.

Biggest immediate use for methyl mercaptan is as a raw material for methionine, an essential amino acid used as a feed supplement for poultry and other animals. And with Du Pont's new methionine plant at Beaumont, Tex., due for completion by the end of this year, Pan American should have an excellent marketing setup.

No Union Yet for Texas City Chemical

The last non-union industrial plant in the Texas City, Tex., area is going to stay that way, at least for awhile.

In a recent, union-called election, workers at the Texas City Chemical Co.'s dicalcium phosphate plant voted down all unionization proposals. But the majority was small and the next election (1955) may well tell a different story.

U. S. Lube Makers May Lose Mexican Markets

The Mexican government has announced that its new Salamanca lubricants plant will go into operation in August. Built at a cost of $26 million, and said to be the largest and most modern refinery for lubricating oils in Latin-America, the plant will have a capacity of 14,000 barrels per day of lubricating oils, greases and paraffin wax.

This may well put an end to the current $10 million a year lubricant importing business in Mexico. Most large U. S. oil companies maintain good-sized facilities for importing and distributing these products in Mexico. They are sold under U. S. brand names and have wide acceptance.

But it is feared that the Mexican government will either completely

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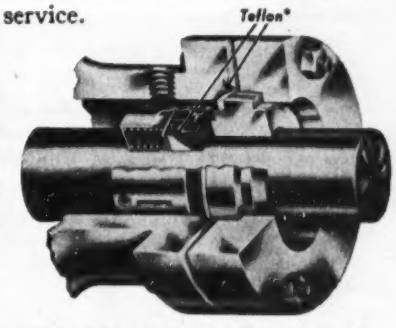
Type 9 MECHANICAL SEAL

Performance records plainly prove that this "John Crane" development has successfully solved the handling of the most difficult corrosive liquids and gases. Where conventional type seals had failed, the Type 9 has done the job. It continues to answer new problems, including temperature conditions from —120°F. up to 500°F.

Designed to withstand practically all chemicals, the Type 9 incorporates a flexible wedge ring and sealing ring molded from DuPont's Teflon. It is engineered for the particular application and can be furnished in the metallurgical specification best suited to the service.



Your toughest problem can be the Type 9's next success story. Use it on all rotating shaft applications, including: centrifugal, rotary pumps, mixers, agitators, autoclaves, other equipment.

Get complete information on the Type 9 Seal from Crane Packing Co., 1809 Belle Plaine Ave., Chicago 13, Ill.

In Canada: *Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.*

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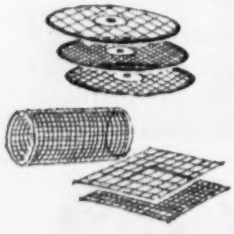

Filter leaves, strainers, sizing screens, etc. We can fabricate most any type of part you need, in any quantity. We'll work from your own prints or, if none are available, our Engineering Department will draw up prints from your description of what the part must do. Once you've O.K.'d them, we'll start production.

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OFFICES IN LEADING INDUSTRIAL AREAS

ban future imports of lubricants or put a prohibitive duty on them after the Salamanca plant goes on stream. However, no official word has been forthcoming as yet.

DECHEMA Group Will Tour U. S. Plants

In preparation for their chemical process equipment show next year, members of DECHEMA, the German chemical equipment association, are planning a trip to the United States this fall. Led by Dr. Herbert Bretschneider, head of DECHEMA, the group will include at least 23 organization members. Other European chemical engineering associations are also being invited to send representatives and the total group may run as high as fifty people.

First stop on the scientific journey will be Philadelphia for the First International Instrument Congress and Exposition, Sept. 21-24, 1954. The next two weeks will be spent visiting U. S. chemical plants and research labs, winding up in Chicago for the Eighth National Chemical Exposition, Oct. 12-14, 1954.

Upon returning to Europe, the visitors will buckle down to final preparations for the eleventh ACHEMA chemical plant and apparatus exhibition and congress. Scheduled for Frankfurt, Germany, May 14-22, 1955, this show is the largest of its kind in the world. More than 600 firms from 12 different countries are expected to show both their regular lines and their latest developments in chemical equipment.

Unlike most American equipment shows, ACHEMA XI features a full program of technical papers and outside plant trips. Over 450,000 sq. ft. of exhibition space will be used—50 percent more than at ACHEMA X in 1952—and attendance should top 50,000.

A likely result of this fall's tour by DECHEMA members is a reciprocal journey to ACHEMA XI next spring by American chemical executives. Plans for such a trip are already being formulated.

Allby Starts Up New Asphalt Refinery

Production has started in the new, $2 million asphalt plant built by Allby Asphalt Refining Corp. in Hammond, Ind. Located on a 150 acre site, the plant will turn out over 50 million gal. of asphalt annually, hence will be the third largest independent asphalt refinery in the U. S.

Besides the actual refining facilities, the plant has 8 million gallons of storage capacity and a brand new asphalt research laboratory. Allby Corp. was recently organized by Byerlyte Corp., Cleveland, Ohio, and Allied Materials Corp., Oklahoma City, Okla.

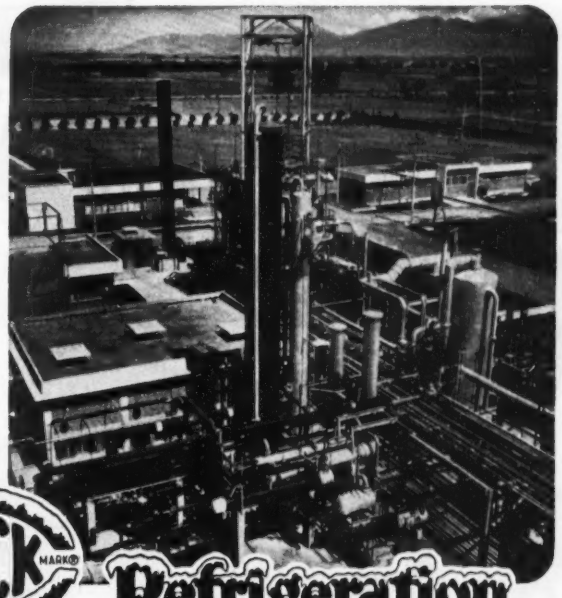
Senate Okays Sale of Army Chlorine Plant

As a direct result of a storm of chemical industry protests, the Army has withdrawn the original invitation to private industry to lease its chlorine plant at Muscle Shoals, Ala. Instead, conditional approval has been obtained from the real estate subcommittee of the Senate Armed Services Committee for outright sale or lease under new terms. Full Senate and House Armed Services Committee approval will be necessary before actual disposal can be made.

Original leasing plans were opposed by the chemical industry on the grounds that chlorine is already in ample supply. Also, there was considerably controversy over the proposed leasing agreement.

The plant, which was built for the Army by Monsanto at a cost of over $23 million, has a rated capacity of 225 tons of chlorine and 250 tons of 70 percent caustic per day. About 200 tons per day of this chlorine was destined for the near-by Chemical Corps phosphate development works. Now, however, this outlet has dwindled to about 105 tons per day.

If final Congressional approval is forthcoming, bids will be opened about July 1, 1954 and will be sent to the appropriate committees for review. Prospective buyers or less-



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Used in Largest Fertilizer Plant in Latin America

Guanos y Fertilizantes de Mexico S.A., the largest fertilizer plant in Latin America, produces 200 metric tons of ammonia sulphate daily, as well as large quantities of liquid ammonia and 200 metric tons of super phosphate.

Frick refrigeration is used to cool a circulating solution of cuprous ammonium formate, a purifying agent in the synthesis process; and to cool high pressure synthesis ammonia gas to condensing temperature to produce liquid ammonia. In addition, a Frick booster compressor is employed to maintain gas pressures in the system.

This is but one of the hundreds of different industrial applications of Frick cooling systems now in operation throughout the world.

No matter what type of cooling is required, there's a Frick-engineered system to fill the bill. Write today for literature and quotations.

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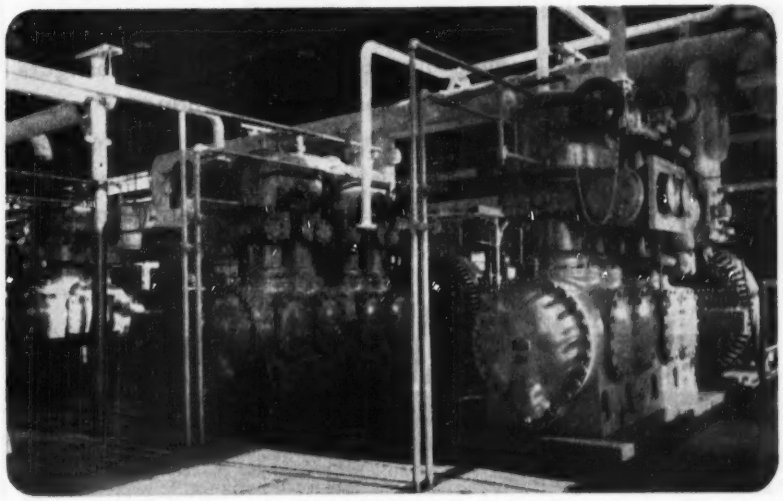

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If you require *extra* qualities in your high alloy pipe, investigate DURASPUN Centrifugally Cast Pipe. We can produce it in OD ranging from 2½" to 24" and in lengths up to 15' according to diameter. Our experience in the field of centrifugal high alloy castings dates back to 1931. Our experience in the field of static high alloy casting goes back to 1922. We can give you good service.

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ces must agree to supply the needs of the phosphate development works and must assure availability of all production needed to meet mobilization requirements.

Odors Eliminated by Scrubber and Burner

A combination fume scrubber and burner installation is being constructed at the Pasadena, Tex., fertilizer plant of Mathieson Chemical Corp. It culminates months of research and experimentation by Mathieson to find a way to get rid of odors from its fertilizer manufacturing operations, according to John R. Beatty, Houston operations manager.

During their research efforts, Mathieson engineers discovered that certain masking agents improved the control of odors at the plant. However, they did not feel that this was a complete and satisfactory solution to the problem.

The new system, which will replace the use of masking agents, will cost about $200,000. When completed in April, the installation is expected to eliminate fertilizer odors arising from Mathieson's operations. This is another step taken by Mathieson in its continuing efforts to control air pollution at its Pasadena plant.

ODM Reopens Chemical Expansion Goals

Production expansion goals for eight chemicals have been reopened by the Office of Defense Mobilization. Simultaneously, ODM closed out goals for eight other chemical products.

Most significant action was an increase in the nitrogen production goal to a capacity of 3.5 million short tons per year of contained nitrogen. This includes all forms of nitrogen, such as synthetic ammonia, by-product ammonia and nitrophosphates.

The move represents an expansion of about 1,813,000 short tons over the industry's capacity in 1950 and provides for 570,000 short tons over the goal established in 1952.

However, this figure includes 165,000 tons previously contained in the phosphatic fertilizer goal, so the net increase is 405,000 tons.

The other seven chemicals whose goals have been reopened are formaldehyde, glycerin, lithium compounds, medical supplies and equipment, pentaerythritol, synthetic methanol and toluene.

The chemicals whose production expansion programs were closed out are benzene, elemental phosphorus, hexamethylenetetramine, hydrogen peroxide, penicillin, sodium bichromate, sodium chlorate and sulfuric acid.

New Phenol-From-Cumene Plant Goes on Stream

Standard Oil of California's long-awaited, 35 million lb. per yr. phenol-from-cumene plant has begun operations at SOCal's Richmond, Calif., refinery. Oronite Chemical Co.—a Standard subsidiary—will market the phenol along with 20 million lb. per yr. of by-product acetone.

The plant is the first in the U. S. to use Hercules Powder's cumene hydroperoxide process, second in the world to B. A. Shawinigan's Montreal, Can., plant (See *Chem. Eng.*, Aug. 1953, p. 114). Unlike the Shawinigan plant, which uses coal tar benzene to make its cumene, Standard gets all its benzene from petroleum via Platforming.

Cumene for the process comes from the company's El Segundo, Calif., refinery through a process developed and licensed by California Research Corp., another SOCal subsidiary. It involves liquid-phase reaction of propylene and benzene, using a phosphoric acid catalyst.

At Richmond, cumene is air oxidized to form cumene hydroperoxide. Acid cleavage of the oxide produces phenol with an over-all 80 percent yield. The ratio of reaction products is 57 parts phenol, 34 parts acetone, 6 parts α-methyl styrene and 3 parts acetophenone.

Standard estimates 60 percent of the end use of phenol goes to

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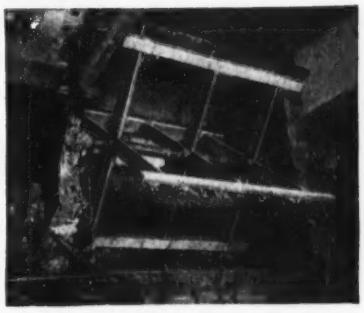
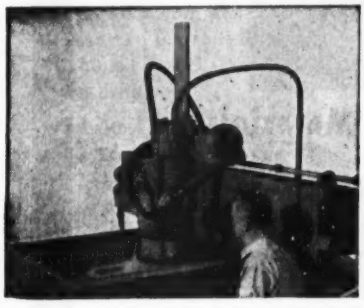


Recovering 1000 Pounds of Raw Wool Each Week from Sewer



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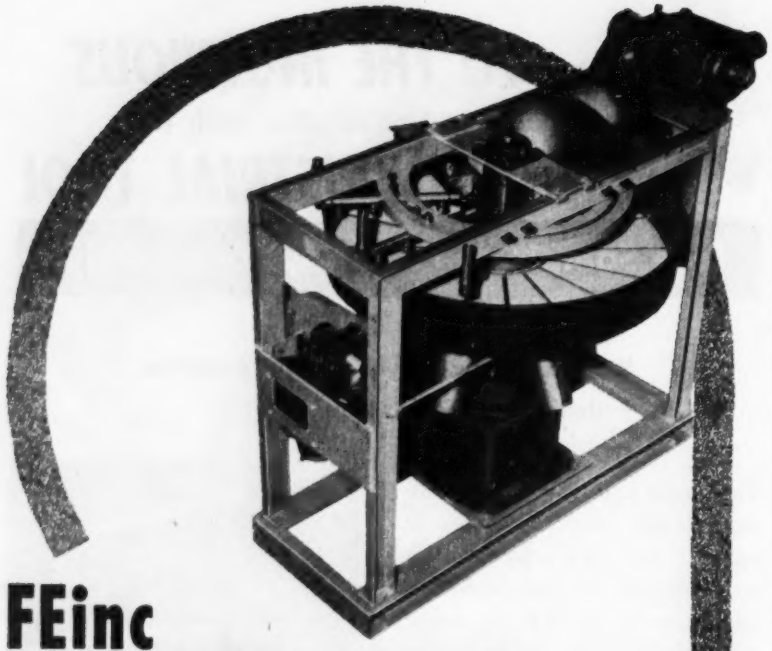

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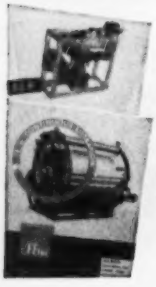
Best for Free-Filtering Materials

For continuous separation of free-filtering materials such as coarse crystalline or fibrous pulps, the new FEinc Horizontal Rotary Vacuum Filter is the simplest and fastest type available. It offers six advantages:

(1) Hourly output is extremely high; (2) Multiple-stage or counter-current washing provides maximum recovery of solubles with minimum dilution; (3) Results are always visible, easy to control; (4) Cakes can be built up to 4" or more; (5) Central-mounted drive simplifies installation and maintenance; (6) It is available with totally enclosed rubber-covered or other special constructions.

The FEinc Horizontal is only one of many continuous filters now made by Filtration Engineers. Our Engineering service is the finest available, backed by 35 years of experience, and by the ability to deliver filters that are *tailor-made* to fit the job . . . at no more than standard costs. Whatever the filtration problem, talk to FEinc first.



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Filtration Engineers, Inc.

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FEinc

155 ORATON STREET • NEWARK 4, N. J.

WHAT'S HAPPENING . . .

phenolic resins. But although the Pacific Coast is a big consumer of these resins, there's at least reasonable doubt that the area will be able to absorb Standard's 35 million pounds on top of Monsanto's 22 million from its new, nearby Avon, Calif., plant.

Use of Shredded Bark Gives High Combustion

Here's a brand new way to use wood bark as a source of heat for steam generation. Instead of pile or grate burning—the usual method—shred the bark and introduce it to the furnace through a high set spreader stoker.

That's just what the Hollingsworth & Whitney Co. of Mobile, Ala., is doing. Combined with a single pass boiler with swaged tubes, their new unit represents a distinct improvement over older methods of burning bark for steam generation. Practically complete combustion is attained with a minimum of excess air and consequent high efficiency.

The bark is largely burned in suspension after passing through a zone of direct contact evaporative drying. Turbulence nozzles inject air to help keep the bark in suspension and firing is under full automatic control.

Furnace consumption is estimated at 53,000 lb. per hr. of bark (50 percent moisture) in combination with natural gas. The burner can also operate on either natural gas or oil alone. Design capacity of the boiler is 130,000-160,000 lb. per hr., depending on the fuel mixture used.

The boiler was built by Combustion Engineering-Superheater, Inc., New York. Installation was by Rust Engineering Co., Pittsburgh.

Tuscola Plant Furnishing Synthetic Ethanol to CSC

A large part of the total output of 125,000 gal. daily of synthetic ethyl alcohol from the new $50 million plant of National Petro-Chemicals Corp. at Tuscola, Ill., will go to Commercial Solvents

Corp. The two companies have signed a long-term contract.

As a result of this arrangement, Commercial Solvents will strengthen its position as a producer and supplier of industrial alcohol. The move will provide flexibility under all market conditions through supplies of both synthetic and fermentation ethyl alcohol. Deliveries under the new contract are already being made.

Du Pont Will Make Titanium Plant Study

The government, through the General Services Administration, has awarded a contract to E. I. du Pont de Nemours & Co. to make design and engineering studies of a new plant to produce 7-8,000 tons of titanium annually. If built, the plant is expected to cost $30-35 million.

A site adjoining the Tennessee Valley Authority steam power plant between Waverly and Camden, Tenn., has been picked. Raw material will be ilmenite ore which is found in Florida black sand.

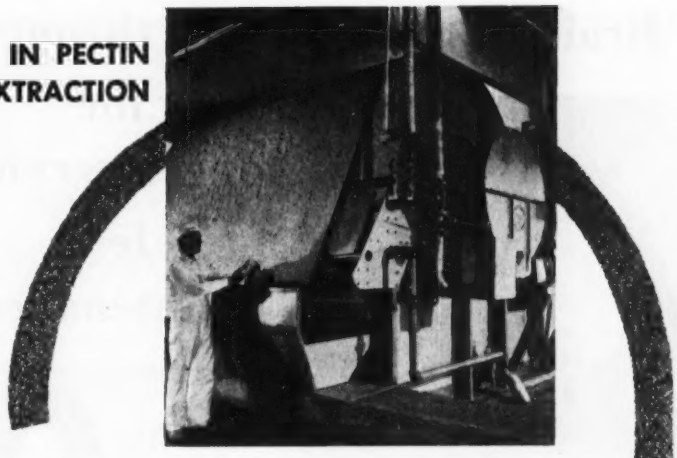
Construction will start immediately after preliminary design work is completed, but only if satisfactory agreement can be reached on financing. If no acceptable purchase contract can be arrived at by Sept. 1, 1954, the government will refund Du Pont's out-of-pocket expenses which are expected to be about $600,000.

Socony Develops Fixed-Bed Catalytic Reformer

Latest in a long list of catalytic reforming processes is Sovaforming, a fixed-bed method that uses a platinum-containing catalyst. Developed by Socony-Vacuum Oil Co., Inc., it will be used on low-sulfur, straight run naphthas.

This is the second Socony cat reforming process. The first was Thermofor catalytic reforming (TCR), a continuous process that's used to reform high-sulfur, cracked naphthas. The chromia-alumina catalyst used in TCR must be con-

IN PECTIN EXTRACTION



One FEinc Continuous Filter Replaces Two Presses and Six Men

Looking at this clean, quiet picture, you'd never know this filtration job was formerly a hot, steamy mess, requiring six men per shift to load and unload wet, acid-laden press blankets, racks and press cars of two stop-and-go hydraulic presses.

Now it's a smooth-running, *really continuous* filtration operation, on this big FEinc String Discharge Filter. Only one operator is now required, with very little to do except watch the cake roll off hour after hour. Even the daily washup takes little time and effort.

Pectin recovery is reported to be as good as formerly. Losses due to leakage and spillage have been eliminated. The dynel cloth on this filter lasts more than a year . . . a substantial saving in the cost of filter cloth.

The pulp is lifted from the filter by continuous orlon strings . . . the famous FEinc String Discharge which successfully handles all types of cakes ranging from thin slimes to thick heavy sludges. There's no smearing, blinding or plugging of the fabric, and no loss due to "blow-back."

You too can improve production rates at lower cost in many of your filtration operations with the continuous . . . *really* continuous . . . FEinc String Discharge Filter. Find out more about what these versatile efficient filters can do for you. And ask about the new FEinc Horizontal Rotary Vacuum Filter for crystalline or fibrous pulps. Write today.

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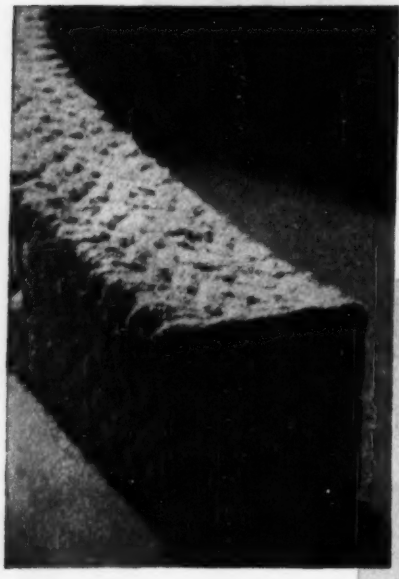

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RUBBER EXPANSION JOINTS

tinuously regenerated due to the nature of the feed stock.

But straight-run naphthas don't foul the catalyst as easily and elaborate regenerative facilities are unnecessary. Thus Sovaforming units will be cheaper to install than TCR units of comparable size.

Socony thinks so much of the new process that it is being substituted in two locations originally slated for TCR units. These will be a 3,000 barrel-per-day unit now under construction at the company's Augusta, Kan., refinery and the 6-8,000 barrel unit contracted for General Petroleum's new Ferndale, Wash., refinery.

More Lithium Coming From Foote Mineral

A tentative green light has been given by the directors of Foote Mineral Co. for a second round of lithium expansion. Total expenditures of about $3 million will come right on top of the company's recently completed $3 million expansion of facilities for producing lithium ores and chemicals.

The proposed move, which has been under study for nearly a year, includes major additions to the company's Kings Mountain, N. C., and Sunbright, Va., plants. The installation at Exton, Pa., will come in for a lesser share. Many of the present facilities were designed and built in expectation of this further expansion.

Where the added lithium and lithium chemicals will go is still Foote's secret. But it's an even bet that the government will need some of it for hydrogen bomb production. Another major user may be the petroleum industry, not only in greases, but in lubricating oils, as well. At least one big oil company is reported to be highly enthusiastic about the potentials of lithium sulfonates as additives for lube oils.

New Atomic Reactor Design Available

The Babcock & Wilcox Co., New York, has prepared a detailed

design of a research atomic reactor and is willing to submit firm bids on both the manufacture and installation of the reactor at any spot in the United States.

According to company spokesmen, "The initial cost of this reactor will be considerably lower than had been thought possible only a few months ago. In fact, construction costs will be below any previous designs of comparable reactors and we believe it will be well within the reach of any university or company engaged in atomic energy research."

The reactor is the fluid fuel type and is expected to produce heat energy in excess of 100 kw., while requiring somewhat less than two kg. of U-235. Demineralized light water is the coolant, concentrated uranyl sulfate the fuel.

Actual construction of a research reactor depends on the Atomic Energy Commission, both for permission and as a source of fissionable material. For latest AEC thinking on this situation, contact Dr. Thomas H. Johnson, U. S. Atomic Energy Commission, Washington 25, D.C.

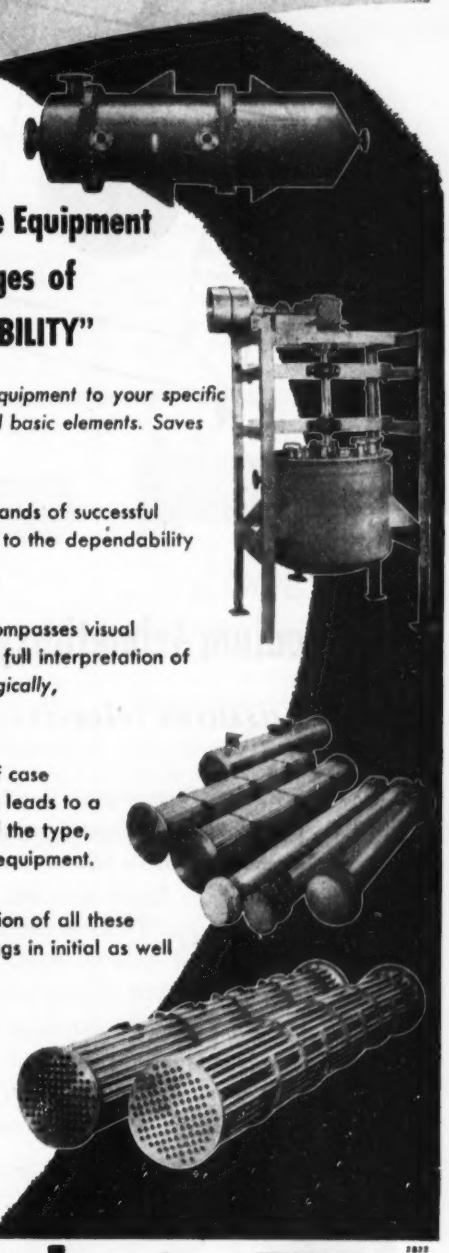
News Briefs

DDT: Michigan Chemical Co., St. Louis, Mich., is turning over complete distribution of its DDT over to Wyandotte Chemicals Corp., Wyandotte, Mich.

Atom Smasher: The University of California's $9 million, 10,000 ton, 6.25 billion electron volt Bevatron has started operations. The most powerful atom smasher in the world, it was built with AEC funds at UC's radiation laboratory. The machine accelerates protons to 4.7 BEV.

Pipeline: Texas Eastern Transmission Corp., has disclosed officially its plans for converting its "little big inch" pipeline to a petroleum carrier and the construction of substitute gas-carrying facilities. A total outlay of about $75.8 is expected.

Custom Built
at competitive cost
of standard equipment



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M & L ECONOMY—A combination of all these advantages adds up to real savings in initial as well as operational costs.

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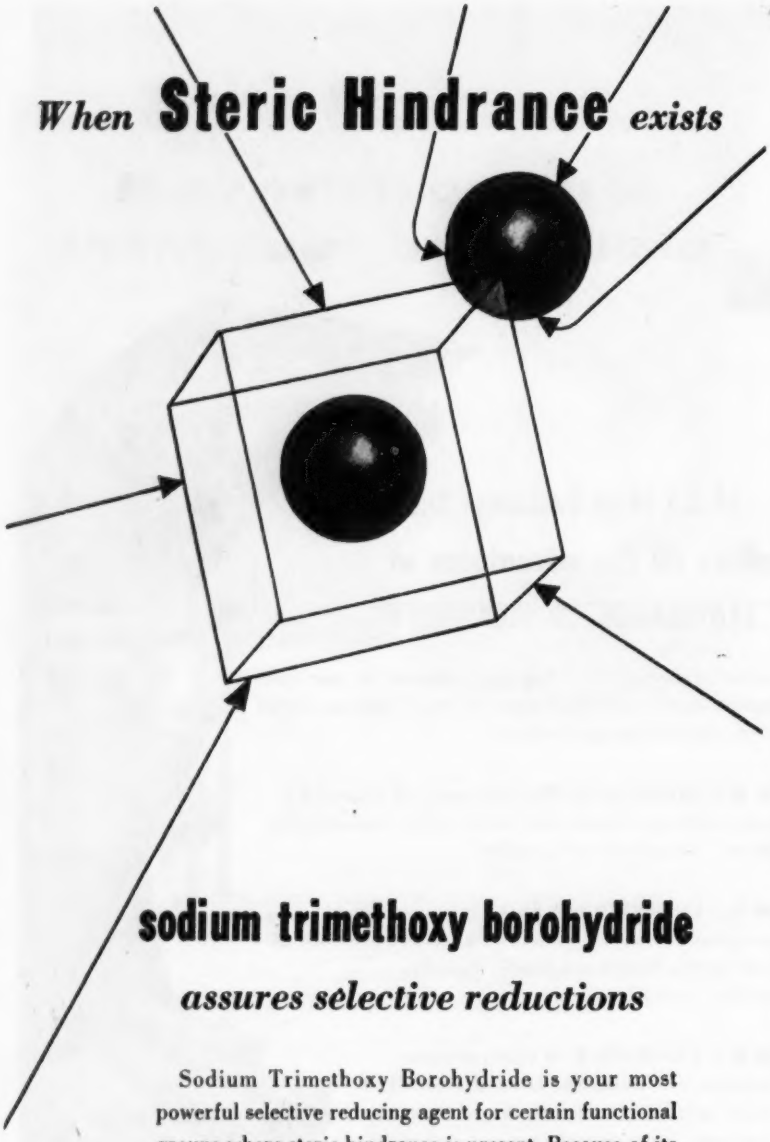

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THIS MONTH'S

Technical

An Atlas of Spectra

INFRARED ABSORPTION SPECTRA, AN ATLAS. By Konrad Dobriner, E. R. Katzenellenbogen and R. N. Jones. Interscience Publishers, New York. 299 pages. $11.50.

Reviewed by C. M. Martini

Certainly this new atlas will become a standard reference book for infrared spectroscopists.

Drs. Katzenellenbogen and Jones have completed the work begun with the late Dr. Dobriner to bring to chemists, and others, handicapped by a lack of data, the spectra of steroids of known structure. Among these are C_{19}, C_{21}, C_{27-29} steroids, bile acid esters, steroid sapogenins, as well as a few representative cardiac aglycones, and steroid alkaloids. Most of the spectra were determined specifically for this atlas.

After a brief introduction, explaining the organization and summarizing some of the structural correlations, there are given 308 spectra. The curves are recorded on a linear wave number scale with the intensities increasing upwards in units of percent absorption. It might possibly have been helpful to those accustomed to a linear wavelength scale if the wavelengths were indicated at the top of the chart. This, however, reduces

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Recent Books Received

Chromium. By A. H. Sully. Academic. $5.50

Collected Papers of Peter W. J. Debye. Interscience. $9.50.

French-English Dictionary for Chemists. By A. M. Patterson. Wiley. $6.50.

Induction & Dielectric Heating. By J. W. Cable. Reinhold. $12.50.

Instrumental Analysis. By J. H. Harley & S. E. Wiberley. Wiley. $6.50.

Introduction to Electronic Absorption Spectroscopy in Organic Chemistry. By A. Gillam & E. S. Stern. St. Martin's Press. $8.

Zirconium. By G. L. Miller. Academic. $7.50.

Bookshelf

L. B. Pope

neither the usefulness nor the excellence of the book. The spectra were determined as solutions in CS_2 and CCl_4, and where this was not posible in $CHCl_3$, using for the most part a Perkin-Elmer Model 21 Spectrophotometer equipped with both NaCl and CaF_2 prisms.

The atlas furnishes workers in the field with another excellent example of the careful, well organized work that one has come to expect of the authors.

Exactly and Competently

ORGANIC COATING TECHNOLOGY. Vol. I, Oils, Resins, Varnishes, and Polymers. By Henry Fleming Payne. John Wiley & Sons, Inc., New York. 674 pages. $10.

Reviewed by Kenneth Tator

This book is stated to be "a concise survey of the chemistry, manufacture, and use of the vehicle components of organic coatings," and it is exactly and competently that. This book describes very thoroughly each of the vehicle raw materials used in paint formulations (drying-oils, resins both natural and synthetic, driers, solvents, rubbers and rubber resins, plasticizers and silicones). It describes each with full attention to the chemical-physical mechanisms which make each of value in paint formulation, their physical and chemical characteristics, their origin and manufacture and examples of their current use in paint manufacture. In the latter regard full detailed descriptions of procedures and equipment are included.

Non-vehicle components such as pigments, fillers, and extenders are not included in this volume, but will be covered by Vol. II, (now in preparation). The last chapter of the book describes briefly, but adequately, the various forms of physical and chemical testing in accepted use for specification and perform-

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Whitlock Type KR Reboiler — for conventional evaporation service. Tube bundle positioned low in shell — minimizes shell size. Design properly considers heat flux, boiling rates, vapor disengagement, fouling, etc. Write for Bulletin 130.

CONDENSING

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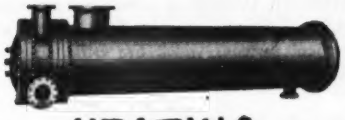

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Whitlock Type S Heater — straight tube, floating head (pull through) type. Designed for easy access to tube bundle . . . for simple maintenance. Particularly applicable to heating of dirty, fouling liquids. Write for Bulletin 250.

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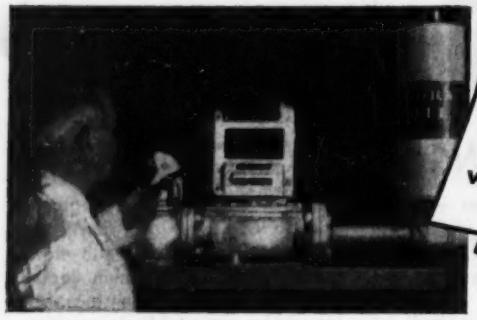

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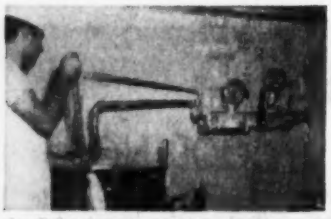

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BOOKS . . .

ance evaluation upon the raw materials and coatings produced from these.

This volume constitutes a very excellent and comprehensive reference on the chemistry and mechanisms of raw materials in paint formulation and manufacture. Much is in the literature on these subjects, but this volume is especially commendable in that it brings this literature up to date in respect to recent developments.

The treatment is especially commendable in that it will constitute a useful reference to all technically trained persons interested in paint technology, regardless of the depth of their background in paint formulation. While it does not "pull any punches" in describing latest mechanisms and theories of oxidation, polymerization, and other film formations, its first chapter competently instructs the reader in the principles of primary and secondary valence forces, polarity, molecular cohesion, orientation, functionality, and polymerization.

This volume should constitute a very useful reference to any person to whom paint formulation, manufacture, or use constitutes an important part of his professional activity. In regard to the maintenance or specifying engineer who is concerned solely with application and performance of applied paint systems, the volume has less utility, although even such engineers sooner or later develop a curiosity toward what makes their paint systems fail or succeed, and in such cases this volume will increase in their use. These men, however, should not look to this volume for detailed assistance in improved methods of application and use of finished paint systems.

Line Imperfections

DISLOCATIONS IN CRYSTALS. By W. T. Read, Jr., McGraw-Hill Book Co., New York. 228 pages. $5.

Reviewed by F. E. Williams

In recent years structural imperfections have been found to dominate many of the electrical, optical,

mechanical and growth properties of crystalline solids. Lattice vacancies and interstitial atoms are well-known imperfections. Dislocations are line imperfections at regions of lattice mismatch. Orowan, Polanyi and Taylor introduced edge dislocations into crystal physics in 1934 to explain plastic deformation. Screw dislocations were devised somewhat later by Burger and have been recently applied by Frank to explain crystal growth without nucleation.

Striking experimental confirmation of these ideas is now available. This textbook provides a detailed elementary treatment of dislocations. Diagrams are used effectively to illustrate dislocation phenomena. The applications of dislocation theory to plastic flow, work hardening, grain boundaries and crystal growth are emphasized.

The interrelations of dislocations with other lattice imperfections are, perhaps, not adequately discussed. However, the solid-state student or investigator interested in acquiring the basic theory and properties of dislocations, without emphasis on the current speculations in the field and without going into the rigorous mathematical aspects of dislocation theory, can profit by studying this textbook.

40 Compounds

ORGANIC SYNTHESES. Vol. 33. Edited by Charles C. Price. John Wiley & Sons, Inc., New York. 115 pages. $3.50.

Reviewed by F. K. Kirchner

The present issue of Organic Syntheses, Vol. 33, represents a third of a century of publishing venture. The issuance of these yearly volumes indicates the wisdom of the establishment of this series and the fulfillment of a continuous need. To the practicing organic chemist the series needs no introduction. To those just entering the field one can refer them with confidence to any of the volumes including the present one under review.

Volume 33, under the editor-

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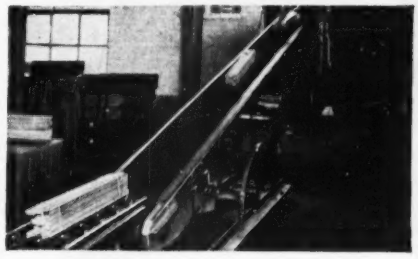

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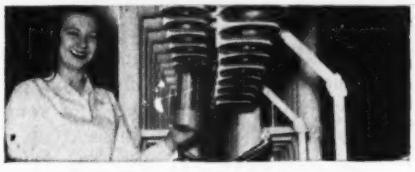

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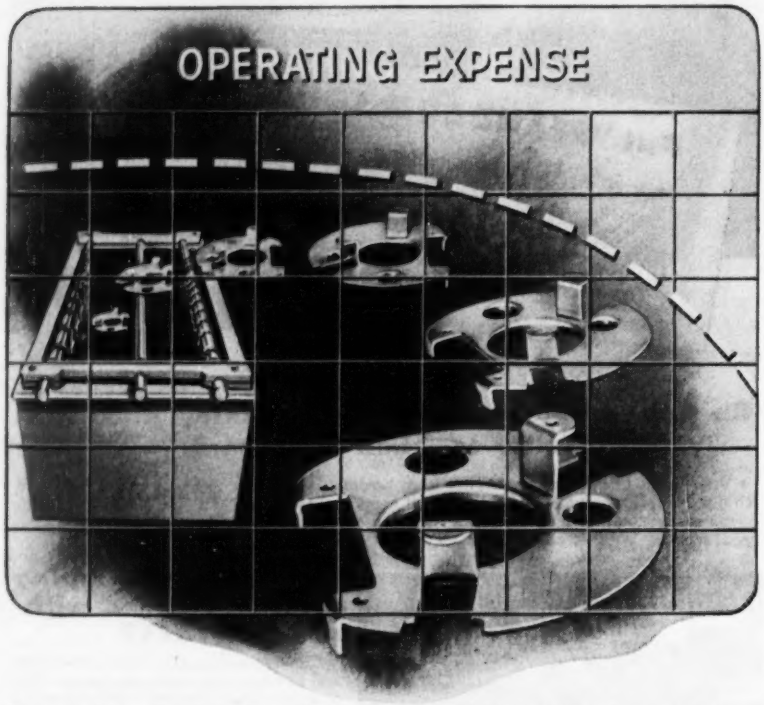

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BOOKS . . .

ship of C. C. Price, is a worthy addition to its precedessors. It contains annotated procedures for the preparation of 40 different compounds. Each procedure has been checked by another group of chemists to insure reproducibility. Following the policy of previous volumes safety precautions are emphasized. The current volume contains a loose insert to be placed in volume 32 reminding us of the impact-sensitivity and thermal instability of the sodium salt of nitromalonaldehyde.

The volume also carries with it an international flavor as there are 14 contributors from seven different foreign countries. The desirable feature of carrying a cumulative subject index for volumes 30-33 inclusive has been continued.

To those who first edited these volumes and conceived their usefulness should go the gratitude of the many who have benefited.

The Most Compact Statement

GENERAL CHEMISTRY. 2nd Edition. By Linus Pauling. W. H. Freeman and Co., San Francisco. 722 pages. $6.

Reviewed by E. Banks

Professor Pauling presents this revision of his well-known textbook as "especially suited to use by first-year college students who plan to major in chemistry and by other well-prepared students with a special interest in the subject". Those teachers of chemistry who wish to emphasize fundamental principles, including a thoroughly modern treatment of atomic and molecular structure, will welcome this revised edition of "the *hard* Pauling" with open arms.

Particularly noteworthy are the new Chapters 3 and 8, on "The Electron and the Nucleus" and "Quantum Theory and Molecular Structure," respectively. These chapters are exceptionally useful tools in teaching the experimental background to atomic theory, as well as in showing the development of the ideas. Most of the material

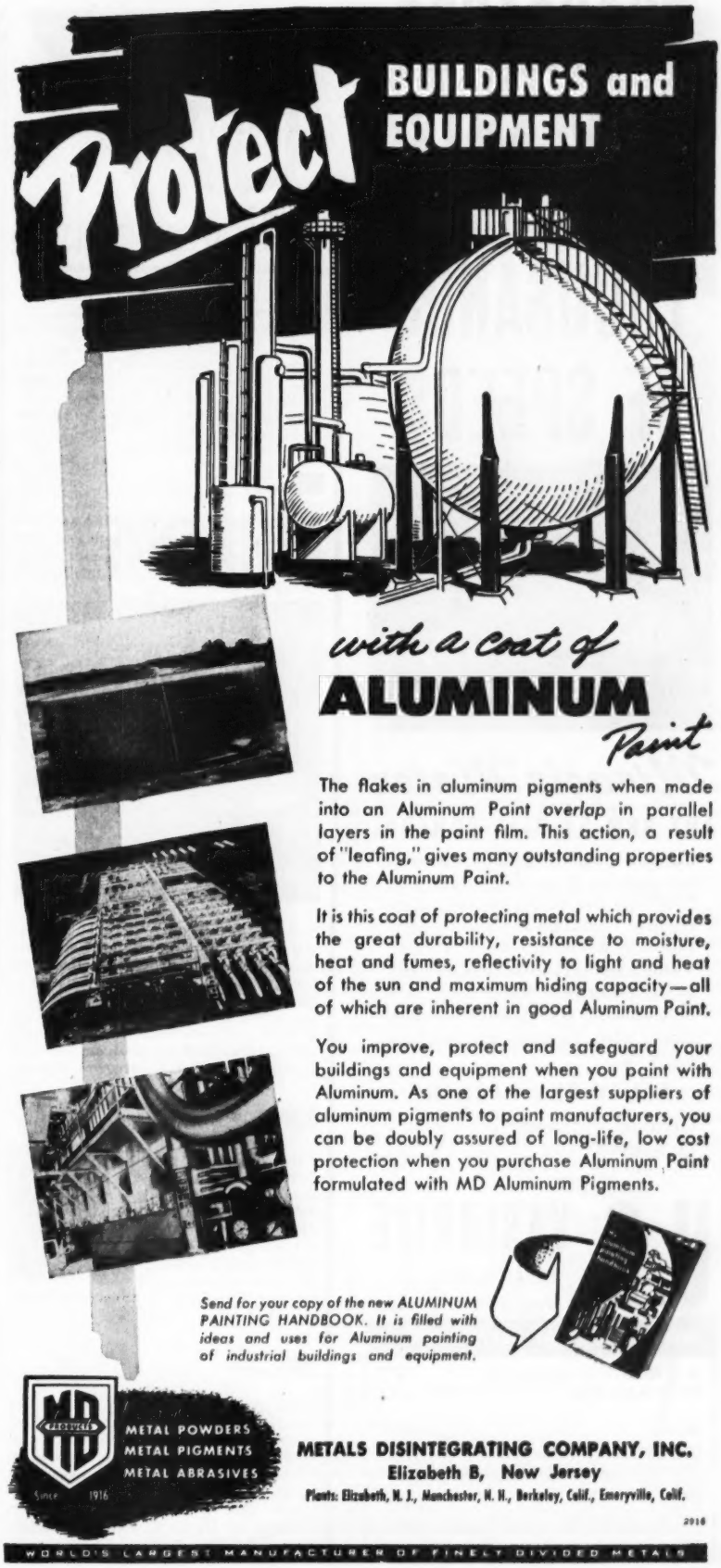
from the first edition has been brought up to date with the inclusion of material out of the most recent literature.

It is impossible in a brief review to discuss a book of this scope in any detail. In general, the book is very strong in its treatment of basic principles and fundamental theory. In its coverage of descriptive material, the book varies from brilliant in some sections to pedestrian in others. The latter seems to be concentrated in those sections involving classical inorganic chemistry—"the chemistry everyone knows." The present reviewer has had his own difficulties in presenting such material as "Compounds of the Alkali Metals" in an interesting way. Perhaps the solution would be to relegate such material to tables and confine textual discussion to general statements (possibly adding some of the more modern developments). This paragraph should not be closed without noting that the brilliant sections far outnumber the others.

The material is organized in a highly logical fashion which makes the book somewhat difficult to teach from, mainly because of the problem of organizing laboratory work. The solution we have adopted at the Polytechnic Institute is to reorganize the lecture work to fit in a reasonably integrated laboratory schedule.

The problems seem to be insufficient in quantity or diversity for a first course for majors in chemistry and chemical engineering. This too can be overcome by the use of a judicious selection of supplementary problems. The only feature of the text which I found questionable is the use of the oxidation number method for balancing oxidation reduction equations rather than the widely-accepted ion-electron method.

This book is strongly recommended for well-prepared classes with a pronounced orientation toward the physical sciences. In addition, practicing industrial chemists and chemical engineers will find it to be perhaps the most compact statement in print of the modern status of chemistry.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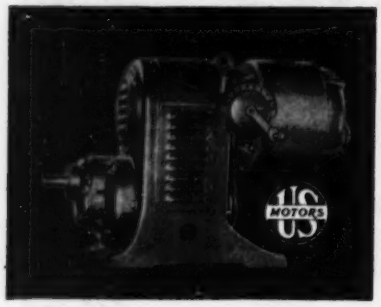

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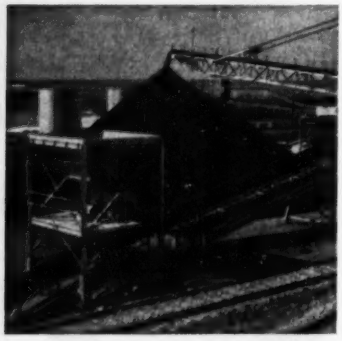

Jamaica. Self-heating truck bodies and other specially designed handling methods licked this problem. At the same time, the versatile talents of Kaiser Engineers were focused on all other facilities at the island mine: housing, drying, storage, a 995-foot dock, 13 miles of railroad and a 1,000 ton-per-hour conveyor loading system being just a few of them.

Chemical Business Handbook, just published, is the title of a valuable new book edited by John H. Perry. It is a reference book of modern business management keyed especially to the needs of the chemical and chemical engineering industries.

When it comes to research, preliminary engineering studies, engineering design and layout, estimating, preparation of specifications, construction programming, negotiation of contracts, and procurement and expediting of materials and equipment – call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

THIS MONTH'S *Recent Books*

Colorimetric Methods

A collection of detailed technical instructions for laboratory technicians working with Lovibond comparators. Includes methods for pH, chemical analysis, toxic gases; using Lovibond instruments. 206 pages.

"A Handbook of Colorimetric Chemical Methods." Curry & Paxton, Inc., 101 Park Ave., New York 17, N. Y. $5.

Radioactive Waste Disposal

A booklet of recommendations, from the National Bureau of Standards, for getting rid of carbon-14 wastes. Dilution, incineration, burial, sewer discharge, are some of the methods discussed. 14 pages.

"Recommendations for the Disposal of Carbon-14 Wastes." National Bureau of Standards Handbook No. 53. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 15c.

Time Data Handbook

A book of standard time data for establishing machine shop time values. The data are set up in convenient tables. Such operations as lathe turning, milling, drilling, grinding, arc welding are included. 473 pages.

"Handbook of Standard Time Data." by A. A. Hadden and V. K. Genger. 1954. The Ronald Press Co., 15 E. 26th St., New York 10, N. Y. $10.

Soybean Statistics

The latest available statistics on production, prices and utilization of soybeans, meat and oil. Includes directories of soybean processors, oil refiners and manufacturers using soy products in their operations. 160 pages.

"Soybean Blue Book". American Soybean Association, Hudson, Iowa. $3.

& Pamphlets

Manpower Utilization

Proceedings of a manpower conference held at Columbia University in Oct. 1953, under the sponsorship of the National Manpower Council. The book, containing an account of conference discussions, is divided into three major sections: (1) major aspects of utilization problems, (2) utilization of engineering, medical, and teaching personnel and (3) approaches to improved utilization. 197 pages.

"The Utilization of Scientific and Professional Manpower." The National Manpower Council, Columbia University Graduate School of Business, New York 27, N. Y. $3.50.

Steam Contamination

In this bibliography there are 1,085 references on—contaminants in steam and how to determine them; mechanical and chemical factors contributing to steam contamination; and corrective measures—such as equipment design, pretreatment of boiler feed-water, antifoam treatment.

"Bibliography on Steam Contamination." Order Department, The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. $2.50.

Illinois Tech Publications

A listing of publications issued by the Illinois Institute of Technology for the year 1953. The pamphlet lists abstracts of Ph. D. theses; in addition, faculty publications, Institute of Gas Technology and Armour Research Foundation publications are included in a listing of the author and the article title. 24 pages.

"Publications from Illinois Institute of Technology." Vol. 2, Dec. 1953. Graduate School, Illinois Institute of Technology, Technology Center, Chicago 16, Ill. No charge.

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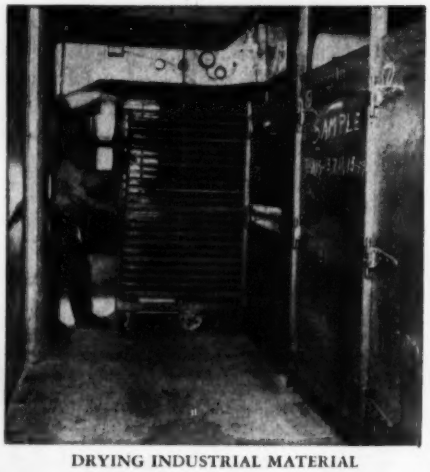

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THIS MONTH'S

Firms in

New Locations

The Virginia-Carolina Chemical Corp.—Office space has been established at 99 Park Ave., New York, for this manufacturer of Vicara fiber and other industrial and agricultural chemical products.

Wolverine Tube Div., Calumet & Hecla, Inc.—Sales offices have been transferred to Room 207, Larson Bldg., 25 So. Bemiston Ave., St. Louis 5, Mo. Kansas City sales offices have been opened at 4050 Broadway, Room 208, in the Broadway-Westport Bldg.

Transmission Equipment Co.—New York sales offices have been moved from 527 Lexington Ave. to the Century Federal Savings Bldg., 441 Lexington Ave. The firm is the New York sales representative for Acme Welding, division of The United Tool & Die Co., West Hartford, Conn.

Vapor Heating Corp., Chicago—Headquarters for this manufacturer of steam generators and electronic controls have been reestablished at the firm's new plant address: 6420 W. Howard St., Chicago.

New Lines

Airlenco Inc., Mansfield, Ohio—The proprietary business formerly operated as Air-Line Engineering Co. has been taken over by Airlenco. The same equipment will be produced with some additions to the line.

The Parker Appliance Co., Cleveland—Thirteen additional sizes have been added to the firm's line of reusable type Hoze-lok fittings. The additions eliminate the need for reducers in many combination size connections when diameter reduction from hose to tubing is desired.

the News

M. A. Gibbons

Mathewson Corp., Inglewood, Calif.–Entry into the field of special- valves has been an nounced by this manufacturer of special sealing parts. For the present the firm will concentrate on swing and disc type check valves, vent, line, etc., designed for synthetic oils, fuels and chemicals.

New Names

Miller Motor Co., manufacturer of air and hydraulic cylinders, boosters and accumulators, has changed its corporate name to Miller Fluid Power Co. The Melrose Park, Ill., firm indicates that no change in company ownership or policy is involved.

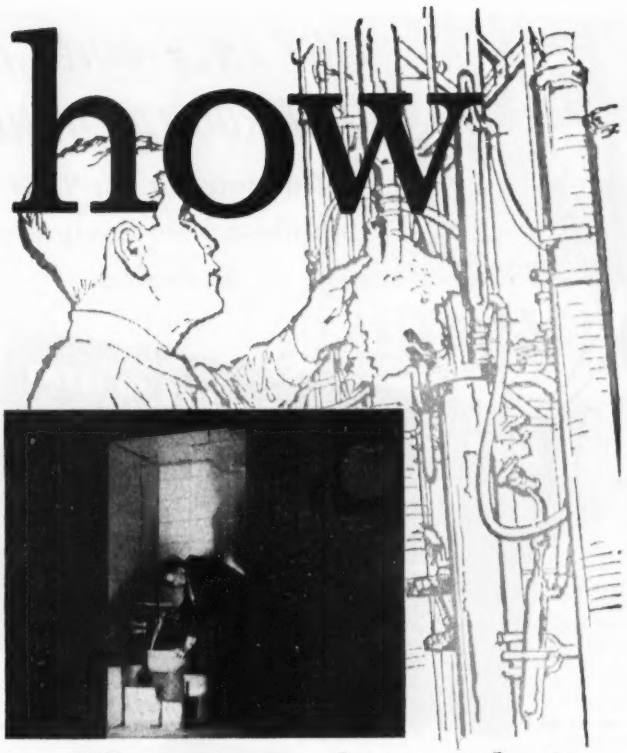
American Car & Foundry Co., New York, is contemplating a change in its corporate name to ACF Industries, Inc., in an effort to more properly describe the firm's growing business in the fields of atomic energy and electronics.

Dekoron Tubing Div., (Samuel Moore & Co., Mantua, Ohio), will now be known as the Dekoron Products Div. The firm produces Dekoron coated instrument tubing and Imprevapak instrument line harness. Copper tubing, plastic tubing, metal and plastic tube fittings and valves are also handled by the division.

New Representatives

Damascus Tube Co., Greenville, Pa., manufacturers of stainless steel pipe and tubing has appointed the C. A. Roberts Co., Detroit, and the Wagner-Fulton firm, Los Angeles as representatives in eastern Michigan and California, respectively.

Atomic Instrument Co., Cambridge, Mass., has appointed H. L. Hoffman & Co., as sales representative for its line of industrial electronic equipment and controls.



Wyandotte takes products around the world in a day

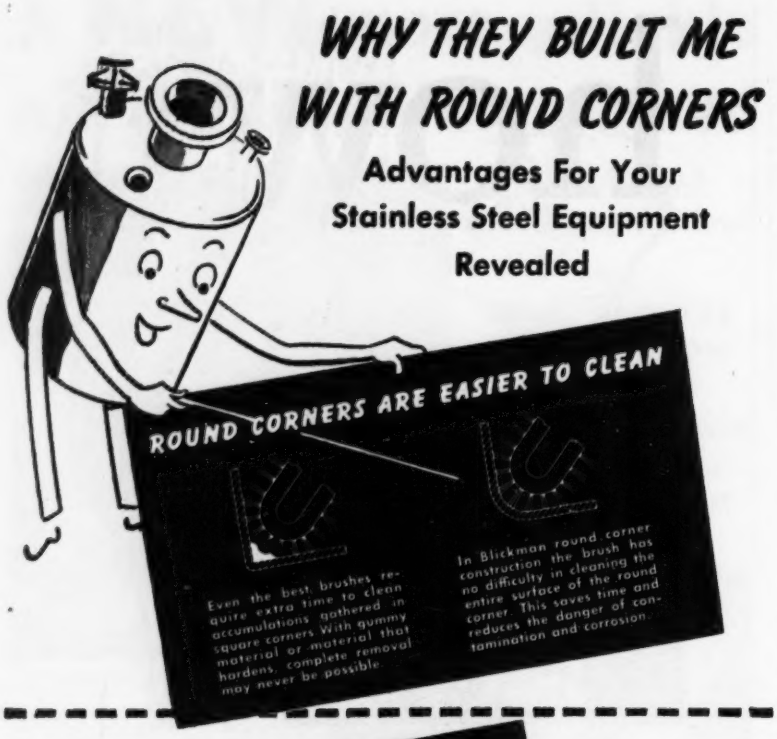
To sell chemicals around the world, you've got to be sure they'll remain saleable and stable under all climatic conditions. Wyandotte Chemicals Corporation makes certain in controlled-temperature-and-humidity rooms built into its new Research Center at Wyandotte, Michigan.

Research engineers can expose products and packages to years of specific climatic conditions in a matter of hours and minutes. They can hold temperature and humidity constant, or vary them on a predetermined cycle. Conventional heating and cooling units deliver temperatures ranging from 140°F. to 25°F. Humidity is controlled by Kathabar equipment, which delivers relative humidity ranging from 80% to 1.3%.

Kathabar's precision control of humidity has helped industry not only in laboratory applications, but also in the processing, packaging, and storage of many products. With Kathabar, you can literally manufacture any RH on earth.

Kathabar
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORP., TOLEDO 1, OHIO
ALSO MAKERS OF
Surface INDUSTRIAL FURNACES Janitrol AUTOMATIC SPACE HEATING


WHY THEY BUILT ME WITH ROUND CORNERS
Advantages For Your Stainless Steel Equipment Revealed
ROUND CORNERS ARE EASIER TO CLEAN
Even the best brushes require extra time to clean accumulations gathered in square corners. With gummy material or material that hardens, complete removal may never be possible.
In Blickman round corner construction the brush has no difficulty in cleaning the entire surface of the round corner. This saves time and reduces the danger of contamination and corrosion.
ROUND CORNERS ARE STRONGER
The ordinates represent the approximate character of maximum stresses in the region of a square corner in a vessel under pressure. Note the considerable increase in stress of the corner.
Stress concentration is entirely eliminated. Discontinuity stresses are smaller. Hence there is little increase in stress of the corner in round corner vessels.
The techniques of fabricating equipment with round corners for efficient service were developed to a high degree in our plant. We use special machinery for this job, as we do for many phases of stainless steel fabrication.
FOR BETTER STAINLESS STEEL EQUIPMENT, CONSULT WITH US.
S. BLICKMAN, INC., 605 GREGORY AVE., WEEHAWKEN, N. J.
S. BLICKMAN, INC.
Guards Alloys in Fabrication
SEND FOR THIS VALUABLE BOOK
A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."
CORROSION RESISTANT PROCESSING EQUIPMENT
TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

FIRMS . . .

Dalmine, S. p. A., Milan, Italy, has appointed Charles A. Koons & Co., New York as exclusive American agents for its products. Dalmine is one of the largest manufacturers of seamless steel used in casing and tubing for the oil industry.

Beckman & Whitley, Inc., San Carlos, Calif., instrument manufacturer, has appointed the Gay Sales Co., Houston, as its representative for eastern Texas and southern Louisiana, handling its line of meteorological instruments and heat-flow transducers.

American Well Works, Aurora, Ill., engineers and manufacturers of waste treatment, water purification and pumping equipment, has selected C. A. Spaulding, Jr. & Associates, Ralston (Omaha), Neb., as sales representatives for Nebraska and Iowa.

Universal Detergents, Inc., Long Beach, Calif., has named the Thompson-Hayward Chemical Co., Kansas City, Mo., as Midwest distributor for its line of Udet F surfactants used in agricultural applications.

Marietta Concrete Corp., Marietta, Ohio, has appointed Mayer & Oswald, Chicago; Matt A. Doetsch Machine Co., Washington, D. C.; Alcar Builders Specialties, Inc., Philadelphia; and Critz Engineering Co., Cincinnati, as representatives for its Industrial Silo Division.

New Companies

Electro Data Corp.—A subsidiary established and wholly-owned by the Consolidated Engineering Corp. The new company will conduct the engineering, manufacturing and sales of electronic digital computers formerly handled by Consolidated's computer division.

Scania's Cellulose Corp., Sweden—This firm has been organized in conjunction with a new pulp factory put into operation for the

NEW!

BART LECTRO-CLAD NICKEL-PLATED

Steel Plated and Sheet

for fabricating into products demanding corrosion and contamination control.

Nickel plated on either or both sides by the electro deposition of pure nickel which provides a permanently bonded, ductile and pore-free cladding up to .020" thick. Produced with a new plating technique developed by BART MANUFACTURING CORPORATION and now available in sizes up to 7 feet x 20 feet.

★ LECTRO-CLAD Plate and Sheet suitable for fabrication into all types of storage tanks, chemical processing vessels and other equipment and installations where corrosion or contamination problems exist.

★ THICKNESS OF CLADDING can be supplied to particular requirements and not necessarily governed by the thickness of the steel plate over which it is applied.

★ ALL RELATED WELDING techniques perfected. No special equipment required.

★ LECTRO-CLAD Plates and Sheets withstand heating, forming, bending and other fabricating processes without change.

Write to Dept. CE-5 for details.

LECTRO-CLAD PLATE is the direct outgrowth of the successful patented BART PROCESS for nickel-lining of seamless steel pipe and fittings.

BART LECTRO CLAD

BART MANUFACTURING CORPORATION

229 Main Street • Belleville 9, New Jersey

Exclusive territories available to qualified distribution organizations

THERE ARE *Filpaco*

Stainless Steel TANKS For YOUR Processing

STANDARD · SPECIAL · ALL TYPES

Your inquiry will receive immediate attention.

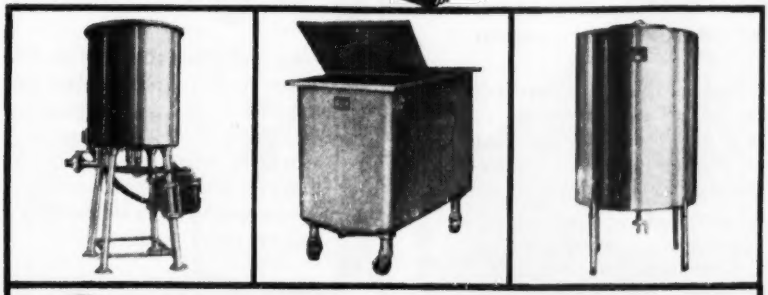
WRITE FOR ILLUSTRATED LITERATURE TODAY!

Get the right tank . . . we maintain stock or fabricate to special designs for your particular need.

Any size . . . any capacity up to 3000 gallons. Horizontal, vertical, rectangular, with side, bottom or top entering agitators.

Also jacketed construction for heating or cooling; insulated.

Accessories: level gauges, thermometers, special covers, special fittings, etc.



FILPACO

FILPACO INDUSTRIES

THE FILTER PAPER COMPANY

2450 S. MICHIGAN AVENUE, CHICAGO, ILLINOIS

PROVED EFFICIENCY makes ANTHRAFILT* #1 Filter Medium!

ANTHRAFILT*

. . . through years of efficient use . . . has become an accepted standard of excellence in the filtering field, so that today it is recognized for its filtering ability, superiority, and the many savings it provides.

ANTHRAFILT*

is made from a *selected* Pennsylvania Anthracite low in ash, high in anthraxylon, low in friability, correctly shaped and sized for best overall results in filtration.

USES INCLUDE

RAPID GRAVITY FILTERS
PRESSURE FILTERS
SLOWFILTERS
HOT PROCESS SOFTENING FILTERS
COLD PROCESS SOFTENING FILTERS
SWIMMING POOL FILTERS
OIL REMOVAL FILTERS
ALKALI FILTERS
ACID FILTERS
MECHANICAL SEWAGE FILTERS
REVOLVING SCREEN FILTERS
SEWAGE SLUDGE-BEDS
PORTABLE FILTERS

ANTHRAFILT* provides greater capacity . . . longer filter runs . . . cleaner washings at lower cost . . . removes entrained turbidity from industrial process solutions or wastes.

Write us today for full details and recommendations. A prompt reply is assured.

PALMER FILTER EQUIPMENT COMPANY

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* *Trade Mark Reg. U. S. Pat. Off.*

ANTHRACITE EQUIPMENT CORPORATION

Anthracite Institute Building

WILKES-BARRE, PA.

1907-CC

...WITH THE CEILCOTE COATING

BEST SUITED TO YOUR PLANT CONDITIONS

CEILCOTE experience takes the "mystery" out of selecting the proper protective coating. Because no single coating will meet all corrosive conditions, CEILCOTE offers eight different types of organic coatings including phenolics . . . asphaltums . . . gilsonites . . . coal tar . . . epoxys . . . polyesters . . . vinyls and furfuryls.

Because CEILCOTE provides a complete range of laboratory tested and field proven protective coatings, there is no need to compromise . . . there is one particular coating best suited to meet your conditions. Send us the details and our staff of chemical engineers will evaluate and recommend a solution to your industrial coating problem.

Write today for new 8 page brochure (No. 150) giving complete information on base formulation . . . adhesion . . . abrasion resistance . . . chemical characteristics . . . film thickness and cost.

THE CEILCOTE COMPANY

CORROSION-PROOF MATERIAL AND CONSTRUCTION

4836 RIDGE ROAD • CLEVELAND, OHIO

FIRMS . . .

Swedish coastal town of Kristianstad. The plant will use a new cellulose process based on the method of separating fibers used in the manufacture of wood-fiber plates.

Sandler Electro-Chemical Corp. and Sandler Medical Gases Inc.—To engage in the manufacture and distribution of all high purity compressed gases for industrial and medical uses.

Fiber Research Corp.—To undertake the commercial development of certain research activities of the National Research Corp., Cambridge, Mass. Fiber Research will concentrate on research on equipment for the grading of natural and synthetic fibers.

The Greibach Instruments Corp.—This new affiliate of the Gulton Mfg. Corp. will be closely associated with the parent firm in the production of the new Greibach multi meters. Headquarters for both firms are located in Metuchen, N. J.; laboratories are in New Rochelle, N. Y.

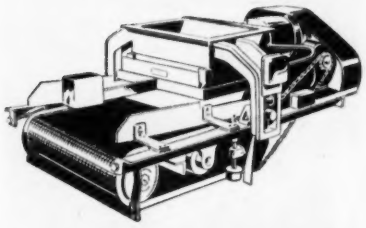
New Facilities

Metallizing Engineering Co., Inc., Long Island City, N. Y.—A Westbury, L. I., plant will be built to greatly increase the firm's manufacturing, storage and shipping facilities. METCO's metallizing process serves industry in the field of corrosion prevention.

Crown Zellerbach Corp., Los Angeles—A $2.7 million plant occupying a 25-acre site provides 11,000 sq. ft. of office space and extensive room for loading operations, in addition to increased production facilities for the firm's various paper products.

Glidden Co., Cleveland Ohio—Additional chemical production equipment has been installed at the firm's Naval Stores Division Jacksonville, Fla., and Valdosta, Ga., plants. The investment—

CONSTANT-WEIGHT FEEDER



A regulating feeder which maintains a positive constant-weight feed rate regardless of feed size or volumetric variation. Bulletin 33-D-11.

GRINDING MILL FEED CONTROLS

"ELECTRIC EAR"®

An electronic mill feed control which increases grinding mill capacity 8 to 20%. Bulletin 42-11.

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COMPANY, INCORPORATED
YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works
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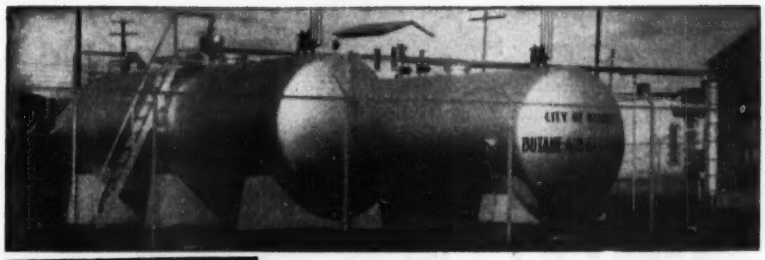


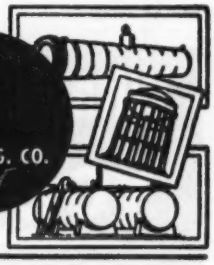
TANKS and vessels that are CORRECT in design

● Whatever your needs in pressure vessels — gas storage tanks, pressure spheres, creosoting cylinders, bubble towers, gas scrubbers, etc. — you can depend on Cole for tanks that are correct in design and permanently leakproof at the welded or riveted joints.

We also design and fabricate elevated tanks, acid tanks, dye vats, digestors, standpipes, storage tanks, etc. Write for latest Cole catalog—*"Tank Talk."*

Established 1854

R. D. COLE MFG. CO.
NEWNAN, GEORGIA



ELEVATED TANKS • VESSELS • CYLINDERS
TOWERS • BINS • STANDPIPES

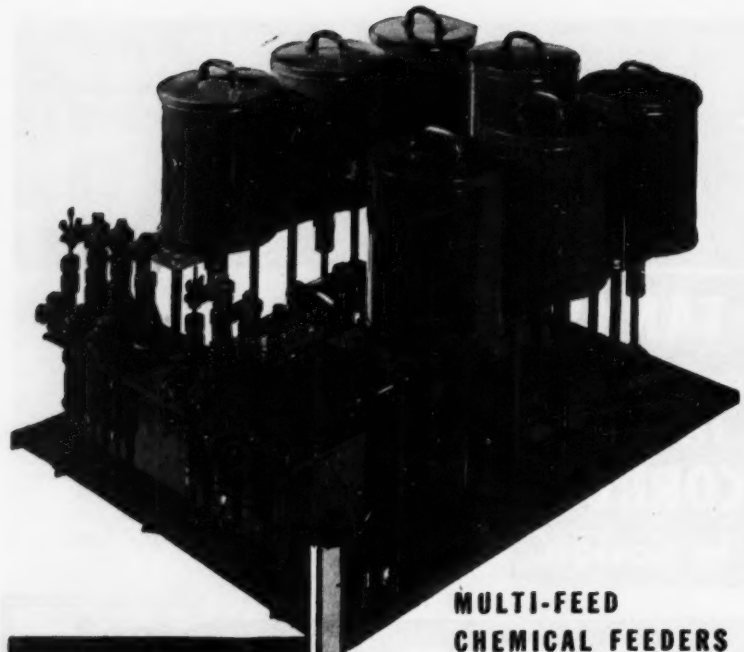
STAINLESS
pipe fittings & fasteners
in STOCK

Complete line of pipe fittings, valves, plugs, bolts, screws, nuts, washers, keys, pins, studs and nails

- Over 9000 items in stock means *immediate delivery* from one source
- New Garden City plant now operating at *top speed and quality*
- Unsurpassed facilities for quantity fabrication of *specials*
- A staff of *seasoned engineers* always available for consultation
- *Pioneers* in the manufacture of stainless steel fasteners

WRITE NOW FOR FREE COPY OF FASTENER MANUAL P6

MANUFACTURERS SINCE 1929
ALLMETAL
SCREW PRODUCTS COMPANY, INC.
GARDEN CITY NEW YORK



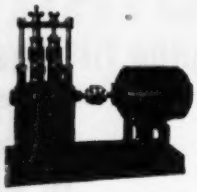
Whatever YOUR Need in Chemical Feeders

MULTI-FEED CHEMICAL FEEDERS

Manzel flexibility permits *accurate* feeding of *many* different chemicals simultaneously. Chemicals can be pumped *into* other liquids or test samples drawn from production at regular intervals. The illustration shows a Manzel with 7 feeds, each of which can be individually set to draw an exact amount of chemical from its own tank.

LARGE OR SMALL CAPACITIES

Manzels Chemical Feeders pump from a fraction of a drop to 60 gph per feed . . . with *unsurpassed accuracy and dependability*. You eliminate troubles due to guesswork, inaccuracy, or forgetfulness. Any number of feeds, any type of drive. Easily synchronized with any process.



● When you have a problem of feeding one liquid into another . . . no matter how light, or heavy, or corrosive . . . you can rely on Manzel's long experience in *precision* proportional pumping.

Manzel Chemical Feeders can be individually engineered for most applications . . . and they are priced much lower than you might expect. Write for details today.

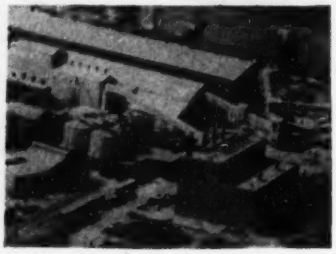
Ask Manzel

Division of Frontier Industries Inc.
324 Babcock Street
Buffalo 10, N. Y.

SPECIALIZING IN HIGH PRESSURE METERING PUMPS SINCE 1898

FIRMS . . .

estimated at $500,000—provides for increased production of terpene chemicals and synthetic resins.



Aluminum Co. of America, Mobile, Ala.—Expansion of facilities at the Mobile Alumina Works of Alcoa has been completed. Capacity of the plant, now the largest alumina plant in the United States, was increased by 33 percent during the expansion program that began in October 1951. To supply the increased demand for bauxite resulting from the expansion, an additional 50 ore ships will be unloaded at Mobile each year. An additional 70 freight cars will be needed each week to ship the increased output of alumina.

The increased facilities will make available sufficient alumina to produce considerably over 100,000 tons of aluminum metal per year. This increase in output, for one year, would be sufficient to keep Alcoa's new Rockdale, Tex., smelter operating for about 15 months.

The new equipment added at Mobile involved all facilities for refining ore under the Bayer Process. Among the several new installations were a digester unit, filter presses and precipitators, and a calcinating kiln.

Dixon Corp., Bristol, R. I.—Extensive enlargement of both production and sales facilities due to an increasing market for the firm's business as a molder and extruder of Teflon and other fluorocarbon plastics.

Monsanto Chemical Co.—A second furnace has been installed for the production of elemental phosphorus at the firm's Soda

PUMP STUFFING BOXES

INFORMATION suggesting solution of common stuffing box difficulties; available in newly revised BULLETIN S-147

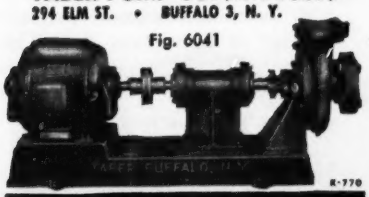
Fig. 19,488

Number of rings, depth of box, type of packing . . . chemical and physical properties of the fluid being pumped, speed of shaft and other pertinent usable facts are in this Bulletin.

WRITE on business stationery for your copy of Bulletin S-147.

TABER PUMP CO. (Est. 1859)
296 ELM ST. • BUFFALO 3, N. Y.

Fig. 6041



R-770

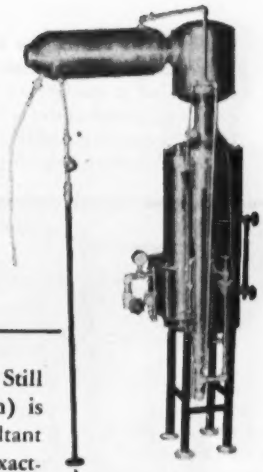
TABER

NO IMPURITIES POSSIBLE

WHEN YOU USE THE

NP WATER STILL

(NON-PYROGENIC)



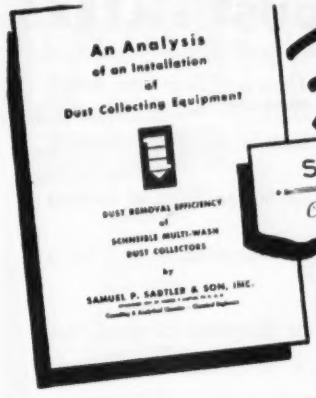
The outstanding feature of every NP Water Still (aside from dependably economical operation) is the fact that no impurities can enter. The resultant distillate is PURE, and suitable for the most exacting and critical needs. This is the result of careful engineering design, the use of the SINGLE COILED TUBE condenser, and the NP Impurity Discharger. The NP Water Still is the most advanced still on the market today.

Steam Heated Stills up to 250 gal. per hour Electrically heated type, up to 10 gal. per hour. Gas Heated, up to 50 gal. per hour. Complete details and specifications promptly available.

CONSOLIDATED MACHINE CORP.

Manufacturers of
Stills, Sterilizers, Autoclaves, Hospital and Laboratory Equipment
Water Demineralizers

39 SUDBURY ST., BOSTON 14, MASS.



Facts prove

SAMUEL P. SADTLER & SON, INC.
ESTABLISHED 1881 BY SAMUEL P. SADTLER PH. D. LL. D.
Consulting & Analytical Chemists · Chemical Engineers

MULTI-WASH

IS *99.9%* EFFICIENT

A recent installation for a large nationally known company, was tested by Samuel P. Sadtler & Son, Inc. of Philadelphia, and proved to be .99.9% efficient. This high efficiency was even better than we had anticipated.

The patented SCHNEIBLE vari-vane construction makes MULTI-WASH the only wet method dust collector that washes dust, fumes and odors out of the air (not once) but many times. As air passes through the unit, maximum scrubbing action and the highest percentage of material removal is assured.

CLAUDE B. SCHNEIBLE COMPANY, P. O. Box 81, North End Station, Detroit 2, Mich.

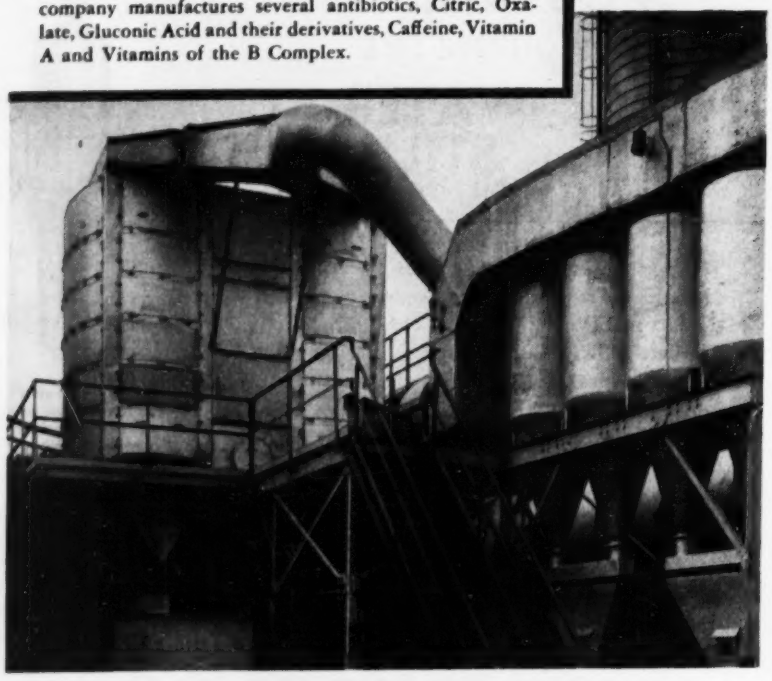
This analysis book *FREE* upon request on your company letterhead.

WRITE TODAY!

SCHNEIBLE

FOR ALL DUST, FUME AND ODOR CONTROL EQUIPMENT BE SURE TO CALL IN SCHNEIBLE

Photo shows two of the eight DAY Reverse Jet Dust Filters used by Chas. Pfizer & Co., Inc. These dust filters are located at the Groton, Connecticut plant where the company manufactures several antibiotics, Citric, Oxalate, Gluconic Acid and their derivatives, Caffeine, Vitamin A and Vitamins of the B Complex.



WHY CHEMICAL PLANTS USE DAY REVERSE JET DUST FILTERS

1. Reverse Jet Cleaning permits the use of more efficient filter media which gives filtering efficiencies up to 99.99+%.
2. Constant air volumes maintained because of continuous cleaning action.
3. Continuous, automatic operation without the necessity of shutting down any section for cleaning.
4. Air-to-cloth ratios to as high as 20 to 1, depending on dust being handled.

If you want to recover product or dispose of dust our Bulletin Number 528 contains new information on dust control. Write ToDAY for this Bulletin.

The **DAY** *Company*

856 Third Ave. N.E., Minneapolis 13, Minn.

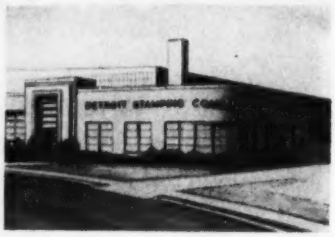
IN CANADA: P.O. Box 70N, Ft. William, Ontario • *Branch Plant:* Buffalo, Fort Worth, Welland, Ontario.

DAY SINCE 1881 DUST CONTROL

A SINGLE UNIT OR A COMPLETE SYSTEM

FIRMS . . .

Springs, Idaho, plant. The new furnace will double present output.



Detroit Stamping Co., Detroit, Mich.—Plant expansion, as a result of an increasing need for additional production facilities, has been completed. The precision valve stamping department has been doubled, while the tool and die section took over the former valve production area.

Oldbury Electro-Chemical Co., Columbus, Miss.—A $250,000 addition to the plant, near Columbus, will provide for the increased demand for the production of sulfide, to be used in the preparation of phosphorus.

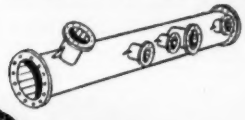
Olin Industries, Inc., New York—The firm has consolidated its New York offices by locating at 460 Park Ave., New York. Olin manufactures explosives, polyethylene, cellophane and powder-actuated tools and fasteners.

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.—Construction has begun on a new service laboratory for the firm's Fine Chemicals Div., in Spartanburg, S.C. The Pittsburgh plant manufactures a broad line of vat dyestuffs for the textile industry.

Tri-State Chemical Co., Webb City, Mo.—Plans have been completed to locate a commercial fertilizer plant at Springdale, Ark. The plant will be erected by the Industrial Committee of the Chamber of Commerce.

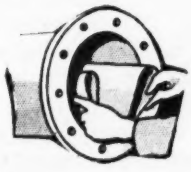
U. S. Rubber Co.—Construction has begun on an addition to the firm's Naugatuck chemical division plant at Baton Rouge, La.

. . . efficient economical answers to your pipeline corrosion problems!



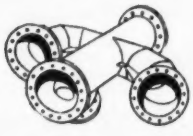
mpc WOOD-LINED STEEL PIPE

Combines the strength of steel with the durability of wood. Provides these outstanding advantages at low cost . . . long life, excellent chemical resistance, greater flow capacity, high structural and impact strength, light weight. Ideal for corrosive liquids, gases and fumes.



mpc SARAN RUBBER-LINED STEEL PIPE

Affords maximum resistance to abrasion, and to corrosive oils, greases, solvents, bleaching liquors, fats, acids and other chemicals and aromatics. All Saran rubber linings are carefully applied by hand and are rigidly inspected by trained personnel and by electric spark testing devices.



mpc FABRICATED PIPING AND ASSEMBLIES

Michigan Pipe Company has been a leader in the production of special purpose piping since 1869. Fabricated pipe, fittings and assemblies are produced to exact specifications in carbon steel, stainless steel and Monel metal.

All types of MPC corrosion-resistant piping come in standard lengths and diameters (6" to 42") as well as on special order to your specifications. For additional information concerning your special needs write to our Engineering Department.

EST. mpc 1869

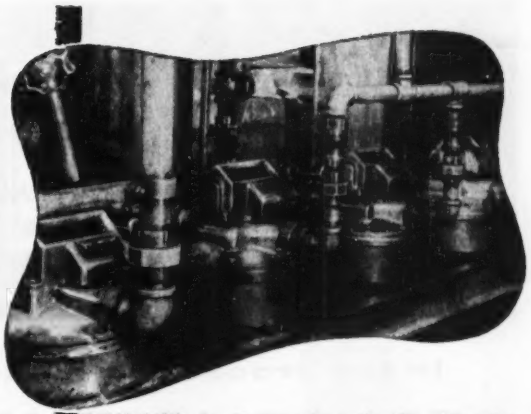
MICHIGAN PIPE COMPANY

BAY CITY, MICHIGAN

you can't beat the accuracy and dependability of

BOWSER

XACTO METERS



XACTO is the meter that's changing liquid-handling habits in every industry where liquid measure and control have been a problem.

XACTO safely handles over 600 different liquids in processing, blending, packaging and many other batching or continuous operations.

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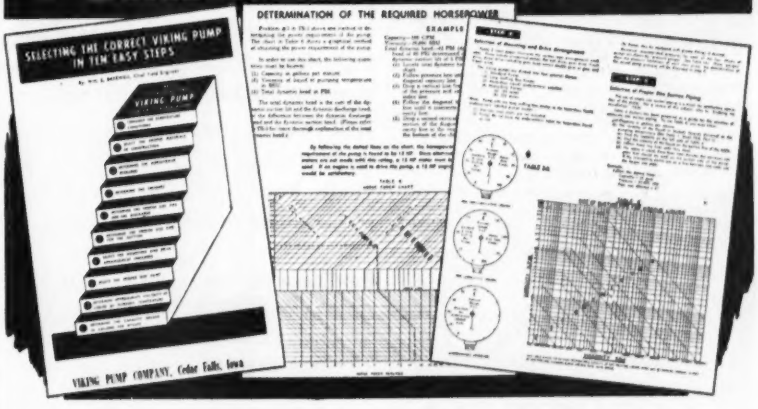
HERE'S MORE INFORMATION TO HELP YOU UNDERSTAND YOUR PUMPING PROBLEMS


SELECTING THE CORRECT VIKING PUMP IN TEN EASY STEPS
VIKING PUMP
VIKING PUMP COMPANY, Cedar Falls, Iowa
DETERMINATION OF THE REQUIRED HORSEPOWER

"Selecting the Correct Viking Pump in Ten Easy Steps," is a ten-page booklet designed to help engineers in choosing the right Viking Pump for each application. This folder is free upon request.

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See Our Catalog In SWEETS

VIKING PUMP COMPANY

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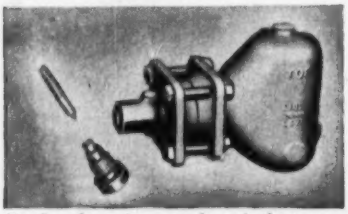
In the processing industries...

REDUCE COSTLY WEAR

with Carboloy® cemented carbides

Dies for the extrusion or pill pressing of highly abrasive ceramics, pharmaceuticals or powdered metals, equipped with Carboloy cemented carbide, remained on the job many times longer than any other material.

In one plant, steel spray nozzles for homogenizing and dehydrating food products lasted 100 hours, due to the corrosive-abrasive action of the food products. Then Carboloy cemented carbide nozzles were used, and nozzle life increased to 3000 hours.



Steel valve stems and seats in a refrigerator regulating valve were quickly corroded and worn by ammonia. To resist this, inserts of Carboloy cemented carbide were substituted. Valve life increased 5 to 6 times.

WHERE ACIDS, alkalis, heat, oxidation and the like reduce equipment life, you can slow down wear, reduce maintenance costs, increase production and improve product quality with Carboloy cemented carbides.

The Carboloy organization manufactures cemented carbides in standard stock items, or designs them to your specifications for spray nozzles, steam valves and orifices for processing foods, soaps and drugs. Plus countless other applications such as core pins for ceramic baking where friction, corrosion, erosion and abrasion must be resisted.

Ask your equipment manufacturer, or write us, about strategic parts made wear-resistant through use of Carboloy cemented carbides.

Put These Outstanding Characteristics To Work In *Your* Plant:

- High abrasion resistance
- High corrosion resistance
- High erosion resistance
- High heat resistance
- High impact strength
- High friction-wear resistance
- Nonmagnetic
- Light weight (where desired)

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SETTING THE PACE FOR INDUSTRIAL PROGRESS

FIRMS . . .

Production of kraslastic, a resin-rubber plastic used in industrial piping and other extrusion molding applications, has been tripled as a result.

The Nickles Machine Corp., Ponca City, Okla.—A major expansion in facilities has tripled present production capacity for the firm's line of replacement parts for stationary diesels, gas engine compressors and pumping equipment for the oil, gas and chemical industries.

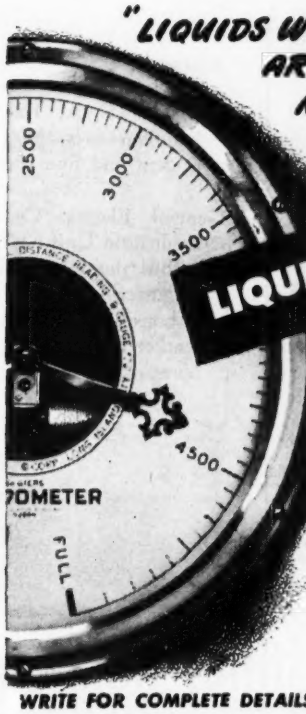
Pope & Talbot, Inc.—The purchase of retorts and other facilities, for treating wood, from the West Oregon Lumber Co., Linnton, Ore., is a part of the firm's plan for a $250,000 expansion of facilities at St. Helens, Ore. New methods of wood preservative using salt chemicals and pentachlorophenol will be employed.

Dow Chemical Co. of Canada, Ltd., Sarnia, Ontario—An ammonia plant expansion of facilities, estimated at $3 million, due to an increasing demand for ammonia in its industrial and agricultural chemical applications.

Frontier Refining Co., Houston—Enlarged and improved catalytic cracking facilities at the firm's plant in Houston have raised designed capacity of the unit from 2,600 to 6,500 b/d. Frontier has also installed a new cooling tower and expanded its polymerization unit.

General Chemical Div., Allied Chemical & Dye Corp.—A $¾ million expansion is now underway in the packaging, shipping and warehouse facilities of its Baker & Adamson Works at

"LIQUIDS WORTH STORING ARE WORTH MEASURING" with a



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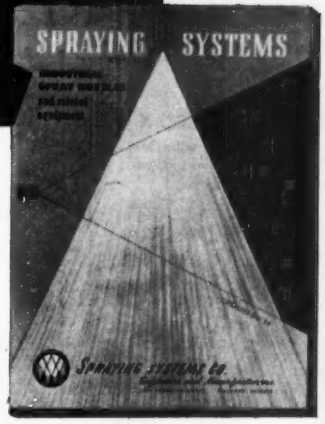

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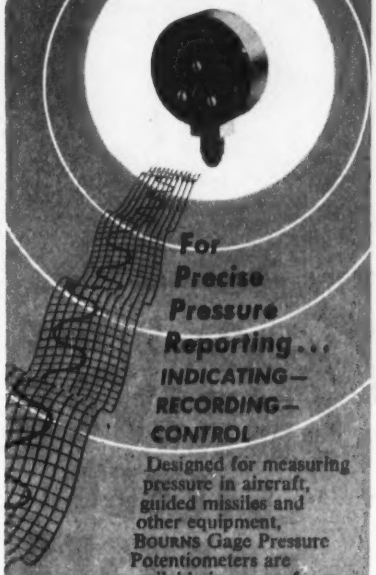
MINIATURE GAGE PRESSURE POTENTIOMETERS



For Precise Pressure Reporting... INDICATING—RECORDING—CONTROL

Designed for measuring pressure in aircraft, guided missiles and other equipment, BOURNS Gage Pressure Potentiometers are available in ranges from 0-100 psi to 0-5,000 psi. Actuated by the flexure of a Bourdon tube, these precision instruments have an electrical output which is linear with the applied pressure. Resolution of 0.4% and power of ½ watt are obtainable in a wide variety of resistances.

Though miniature in size and light in weight, BOURNS Gage Pressure Potentiometers are extremely rugged and accurate. A ball bearing supported linkage system transmits the movement of the Bourdon tube to the sliding contact. Instruments are not damaged by shock, vibration or nominal over-pressure.

BOURNS designs and manufactures other precision potentiometers for measuring position, differential pressure, absolute pressure, altitude and acceleration.

BOURNS is also, the creator and exclusive manufacturer of the TRIMPOT

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WASHING — EXTRACTION — DRYING OF
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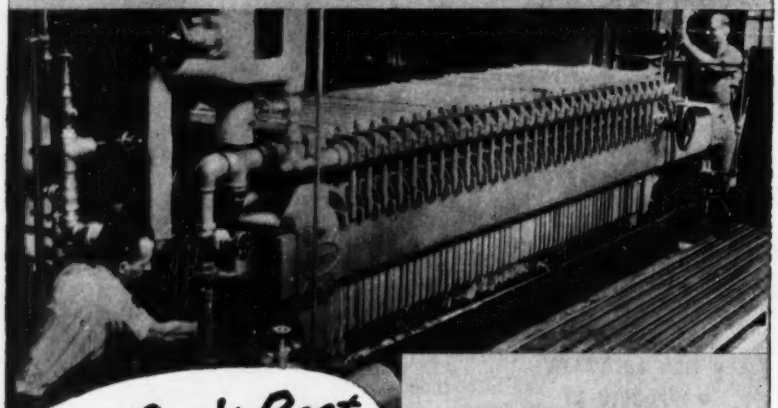

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Made of any required metal, wood, rubber, plastics or coated metal.

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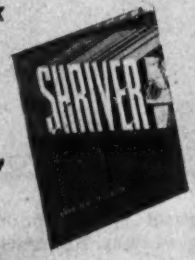
If you want to improve filtration quality and economy, plan on a Shriver Filter Press. No filter matches it for versatility, operating flexibility and assured production capacity under practically any conditions.

Thousands of processing plants use them, and continue to order new Shriver Filter Presses as process changes or expansions arise. There's a Shriver unit for every filtration need . . . from laboratory to large-scale operation.

This Book Proves It — *Get a FREE Copy!*



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FIRMS . . .

Marcus Hook, Pa. The Div. line offers over 1,000 high-purity reagent and fine chemicals.

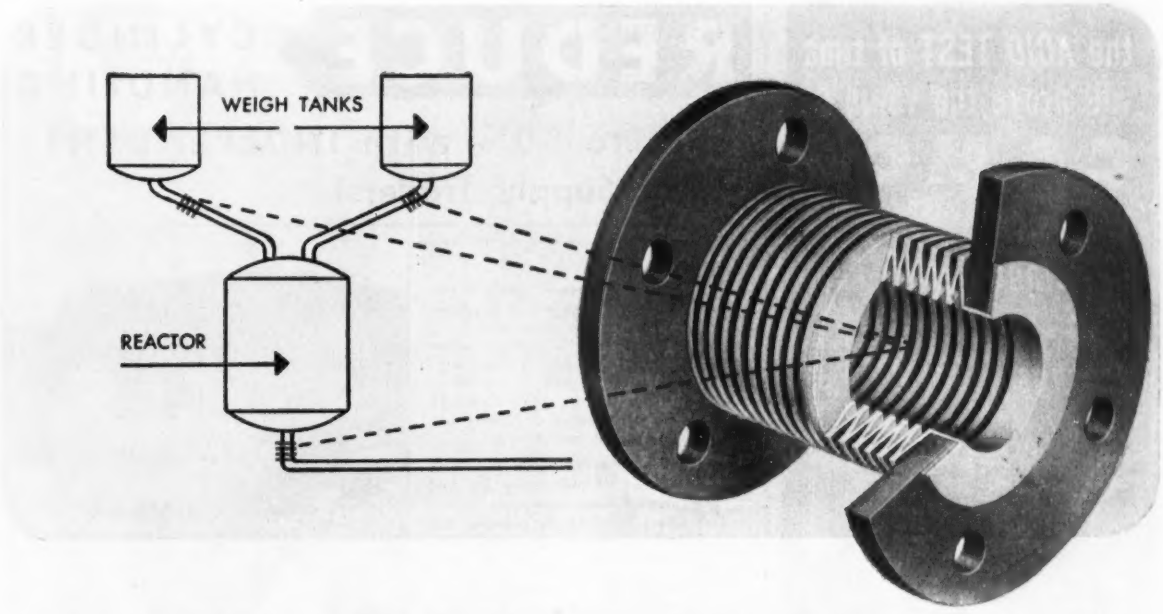
General Electric Co.—A market Evaluation Unit has been formed within the Chemical Division's Engineering department to be responsible for product planning, market research and sales development.

Mesa Plastics Co., Los Angeles—A new and enlarged plant at 11751 Mississippi Ave., Los Angeles has been installed. The facility includes all offices and production facilities for the firm's line of diallyl phthalate molding compounds used in various electronic applications.

Rohm & Haas Co., Philadelphia—Construction of a Canadian plant is underway at Scarboro, near Toronto, Canada, as a part of the firm's expansion program in Canada's agricultural, paint, leather, paper and water treatment industries. The plant will be managed by Rohm & Haas Co. of Canada Ltd., a wholly-owned subsidiary.

New Jersey Zinc Co.—A titanium dioxide plant formerly owned by American Cyanamid Co. has been purchased by the zinc firm. The plant, in Gloucester City, N. J., will be turned over upon the completion of American Cyanamid's new and larger plant in Savannah, Ga.

Emery Industries, Inc., Cincinnati—A direct sales office and warehouse in Cleveland has been opened to increase technical service on all Emery products, including fatty acids and derivatives, plasticizers, textile oils and emulsifiers.



Expansion joint bellows of Du Pont "Teflon" protect your costly process equipment

- *Resist chemical attack*
- *Are non-contaminating*
- *Correct misalignment*
- *Are unaffected by high temperatures*

Du Pont "Teflon"* tetrafluoroethylene resin is a versatile engineering material for the chemical processing industry. Chemically inert to all acids, alkalies and organic solvents, is affected only by molten alkali metals and fluorine at elevated temperatures and pressures. Used as a bellows for expansion joints, "Teflon" is flexible, yet strong. This flexibility compensates for misalignment between connections in pipes joining tanks, pumps or reactors, absorbs vibration, and allows equipment parts to expand and contract safely.

"Teflon" is non-contaminating. Service temperature range is from −450°F to 500°F. "Teflon" is not eroded by impinging fluids. Products made of "Teflon" give dependable service and long service life.

Have you and your company investigated the properties of Du Pont "Teflon" and the other members of the Du Pont family of plastic engineering materials—"Alathon" polyethylene resin, "Lucite" acrylic resin and Du Pont nylon? The application described above is typical of the product improvements made possible when design and service requirements are evaluated in terms of the properties of these unique engineering materials. For further information on the properties and uses of these materials, mail the coupon below.

(Expansion joints manufactured by United States Gasket Co., Camden, N. J.)

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TEFLON®
Tetrafluoroethylene resin
Better Things for Better Living
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Please send me more information on the Du Pont plastic engineering materials checked: ☐ "Teflon" tetrafluoroethylene resin; ☐ "Alathon" polyethylene resin; ☐ Du Pont nylon; ☐ "Lucite" acrylic resin. I am interested in evaluating these materials for_____

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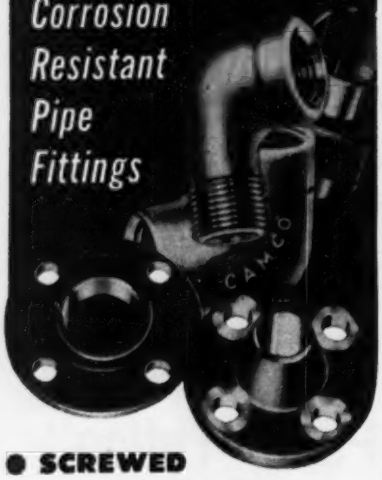
CAMCO

Corrosion Resistant Pipe Fittings



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Stocked in types 304, 304L, 316 and 347. Other analyses and materials on application.

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FITTINGS — All screwed cylindrical fittings to 2" IPS inclusive and all ells, tees and street ells to ¾" IPS machined from forgings at competing cast fitting prices. Sizes over above machined from castings.

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Up to 50% with INDEPENDENT Gas Supply Trailers!

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Many gas manufacturers and haulers of compressed gas (including many government agencies), are already enjoying the many advantages of INDEPENDENT Gas Supply Trailers.

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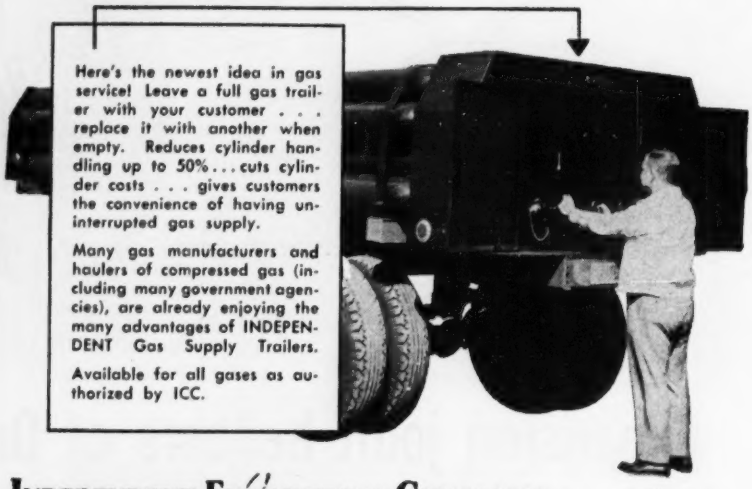

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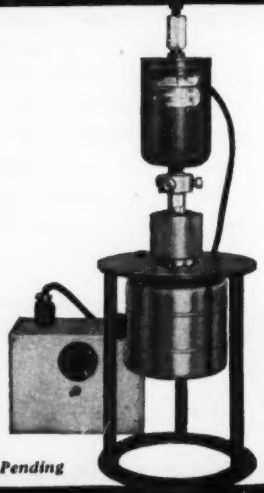

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"We're building our bleach business on quality ingredients"

— Harold R. Nelson, President, Michigan Bleach Corp.

"We are one of the largest producers of concentrated sodium hypochlorite bleach in this area," says Harold R. Nelson, President, Michigan Bleach Corp., Detroit, Mich. "Our product is used principally for treating waste, bleaching of textiles, and some home bleach.

"We know that the life and stability of the finished bleach depend directly on the purity of the raw materials, and just as our customers count on us for this purity, we count on Wyandotte for especially pure Caustic and Chlorine. We also depend on Wyandotte for technical service, special laboratory tests and data, and timely tips on the handling of chemicals."

Have *you* talked to the Wyandotte representative lately? Remember, behind your Wyandotte representative and the high-quality chemicals he sells is a corporation that owns its own salt wells and limestone quarries — one with complete manufacturing and research facilities conveniently located in the great and growing Middle West.

It may help you to discuss your present requirements, and future projects, with Wyandotte. *Wyandotte Chemicals Corporation, Wyandotte, Mich. Offices in principal cities.*

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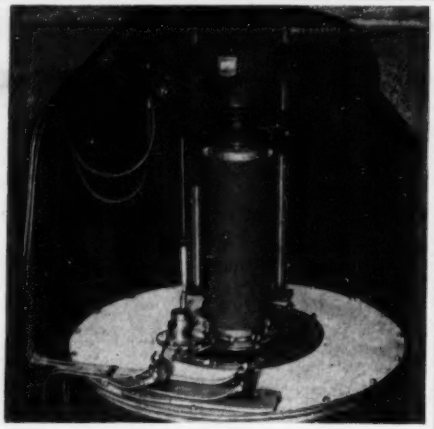
Fletcher

PNEUMATIC UNLOADER FOR CENTRIFUGALS



The latest Fletcher development in its line of modern high-speed centrifugals is the use of pneumatic controls to greatly ease and simplify unloading operation. By this means the back-breaking and fatiguing hand cranking operation is eliminated, and the operator's efficiency is materially increased. The scraper is at all times under complete control.

The air-operated unloader also simplifies the design of a fume hood for noxious gases.

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. . . wherever you have stuffing boxes to be repacked, specify Durametallic "Engineered For The Job" products for longer packing life and satisfactory sealing service.

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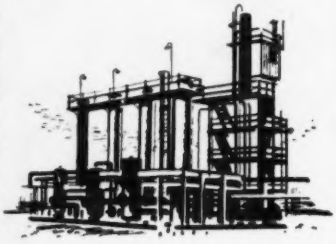
problem

To meet ethylene consumer demand for a product that is essentially free of acetylene.



solution

GIRDLER developed catalysts to selectively hydrogenate the acetylene in the presence of the ethylene. Acetylene content was cut more than 99% giving consumers what they wanted:

Ethylene with less than 50ppm of Acetylene

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FOR *Catalysts*

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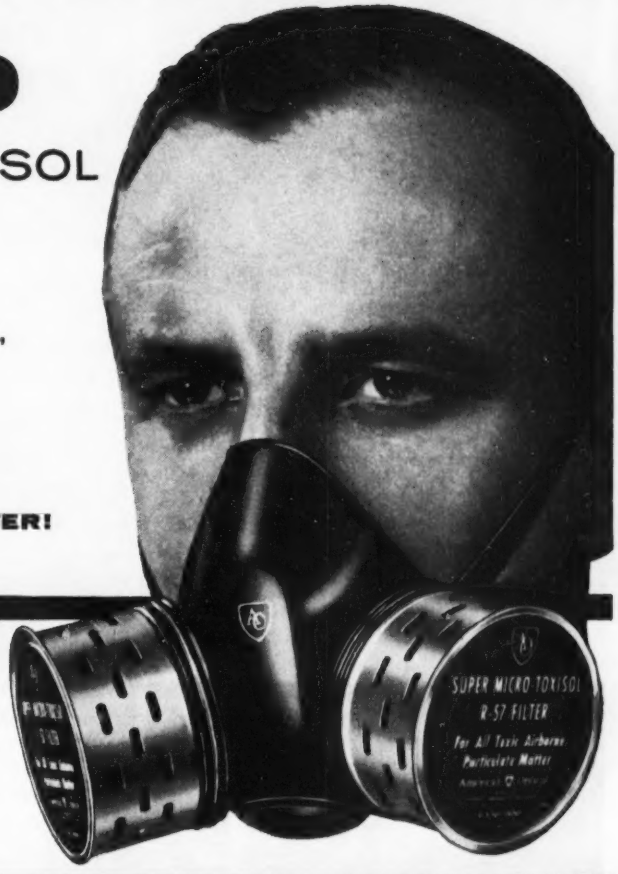
SUPER MICRO-TOXISOL
FILTER R57

Protects Against Dusts, Mists, Fumes, Significantly More Toxic than Lead — including

RADIOACTIVE PARTICULATE MATTER!



99.99% Filtering Efficiency against particles 0.3 micron in size!

With R57 Filters, an AO R5057 Respirator protects against *0.3 micron particles* with a filtering efficiency *greater than 99.99%*. Particles of this size are the most difficult to filter because the effect of the various forces of deposition are minimum at this size. In the R5057 Respirator there are over 90 square inches of filtering area, providing both a low resistance to inhalation and a long service life.

This respirator protects against *all* toxic air-borne particulate matter significantly more toxic than lead, *including radioactive dusts, mists, fumes, and most types of bacteria.* With this filter, protection against aerosols containing compounds of beryllium, selenium, arsenic, thallium, uranium, cadmium, radium, palladium, thorium, phosphorus, and chromium is assured.

AO's R5000 Respirator Series includes 9 interchangeable combinations which offer protection against many different hazards:

1. *With R50 filters* — protection against all dusts (not significantly more toxic than lead) (Bureau of Mines Approval 2156).
2. *With R50A prefilters and R50 filters* — protection against pneumoconiosis-producing mists, chromic acid mists, and all dusts (not significantly more toxic than lead) (Bureau of Mines Approval 2156).
3. *With R51 cartridges* — protection against organic vapors and gases (Bureau of Mines Approval 2304).
4. *With R52 cartridges* — protection against acid gases.
5. *With R53 cartridges* — protection against organic vapors and gases, and acid gases.
6. *With R54 cartridges*—protection against ammonia and other alkali gases.
7. *With R55 cartridges* — protection against all dusts (not significantly more toxic than lead) and organic vapors and gases. (Bureau of Mines Approval 2305).
8. *With R56 filters* — protection against fumes (not significantly more toxic than lead). (Bureau of Mines Approval 2163).
9. *With R57 filters* — protection against all toxic air-borne particulate matter in the form of dusts, mists, or fumes. There's no better protection.

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SAFETY PRODUCTS DIVISION
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Keep your workers in the Safety Zone with American Optical Safety Equipment

Your nearest American Optical Safety Products Representative can supply you

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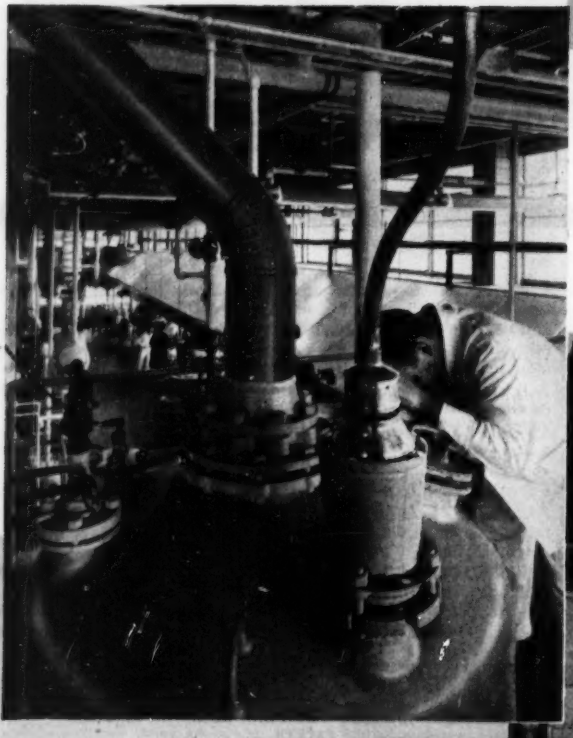
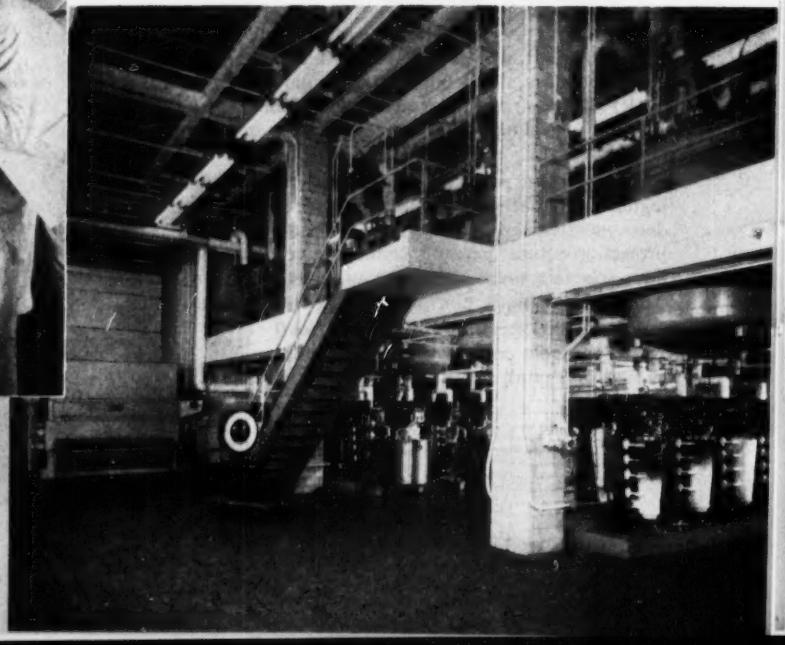
ARMOUR'S NEW LABORATORIES *producing*

Left: **Parenteral Packaging Department.** One of the areas completely air conditioned.



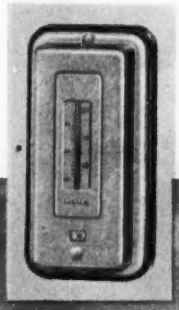
Above: **Hospital Gowned and Masked Technicians in Bulk Sterile Filling Area.** Here the air conditioning is treated in such a manner that aseptic operations could be undertaken with least possibility of bacterial contamination.

Below: **Low Temperature Human Blood Fractionation Plant** — *the largest in the U.S.A.* In this area there are processed 18,000 pints of human blood (or the equivalent of human plasma) weekly into Normal Serum Albumin and Poliomyelitis Immune Globulin. Processes are controlled by Powers V-Port FLOWRITE Valves. This entire room is accurately held at 23° F.



Above: **View in Parenteral Manufacturing Building No. 4** where ACTHAR, Insulin, and Intrinsic Factor (BIO-PAR) are processed. Processes here are also controlled by Powers V-Port FLOWRITE Valves.

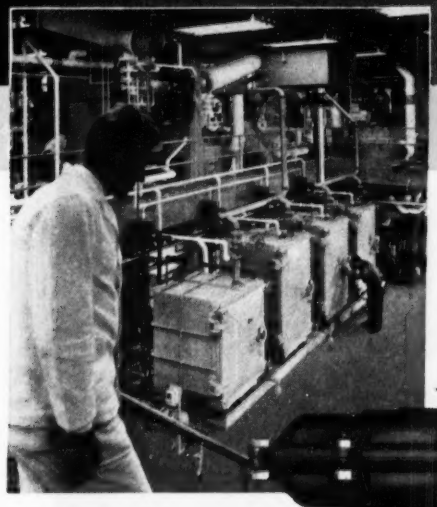
Gamma Globulin and other pharmaceuticals...



Use POWERS AIR CONDITIONING CONTROL AND FLOWRITE DIAPHRAGM VALVES

New ARMOUR PHARMACEUTICAL CENTER, Near Kankakee, Ill.

Architects & Engineers: HOLABIRD & ROOT & BURGEE
Piping Contractor: M. J. CORBOY CORP.



Above: **View in Solvent Extraction Building No. 5** where Insulin, Intrinsic Factor and Injectable Liver are produced. Processes are controlled by Powers V-Port FLOWRITE Valves.

Gamma Globulin for Combating Polio, Serum Albumin used by the Armed Forces for transfusion in shock and burn cases, Thyroid powder and tablets, Intrinsic Factor (BIOPAR), Insulin and ACTHAR for treatment of arthritis – production of these and many other Armour products requires accurate temperature control.

To insure the precision control of air conditioned areas in their modern $12 million plant Armour installed a Powers pneumatic control system. To accurately control the flow of heating and cooling mediums and vacuum used for various processes, they installed Powers V-PORT FLOWRITE Valves.

When you have a control problem requiring the dependable performance assured by Powers products – call our nearest office or write us direct.

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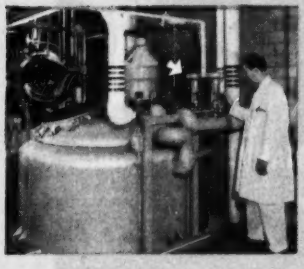
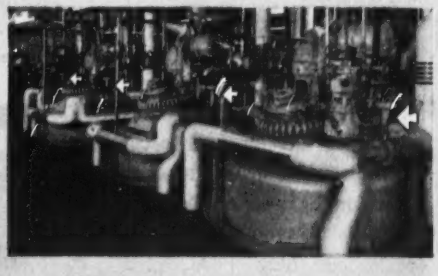


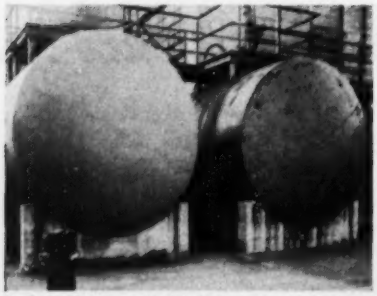
Powers FLOWRITE Valve
Characterized V-PORT Type

Gives BETTER Control with Less Maintenance

Over 100 are Used in Armour Laboratories.



ACCURATELY CONTROLS STEAM, WATER, VACUUM AND PROPYLENE GLYCOL AT ARMOUR LABORATORIES



Left tank: 10-mil-thickness coating after three years' service. Right tank: 3-mil-thickness of same coating after two years' service.

Corrosion Control Plan Passes 3-Yr. In-Plant Tests

PHILADELPHIA, PA. More than three years ago The Pennsylvania Salt Manufacturing Co. began a comprehensive test of 62 different systems for corrosion control. Actual operating plants were chosen as test sites.

As a result of this extensive study, much valuable information has been gained about effective, economical corrosion control. It was found, for example, that annual touch-up is better than a three-year do-over.

Five mils proved to be the minimum coating thickness that would provide adequate protection for a reasonable time. As no more than three coats are generally considered practical for maintenance work, it is necessary, therefore, to use a corrosion-resistant material which provides high build per coat.

To fill this need Pennsalt offers NeoCoat and its companion products. NeoCoat is an air-curing liquid Neoprene coating that produces a thickness of at least five mils with 1 primer and 2 top coats. What's more, the NeoCoat System in extensive plant use showed excellent resistance in aggressive chemical exposures, and returned savings of up to 50% on long-term maintenance costs.

To help you test and apply NeoCoat, Pennsalt provides the invaluable technical assistance of its "corrosioneering" specialists. Literature and specifications sheets are available upon request. Write: Corrosion Engineering Dept., Pennsylvania Salt Manufacturing Company, 658 Widener Bldg., Philadelphia 7, Pa.

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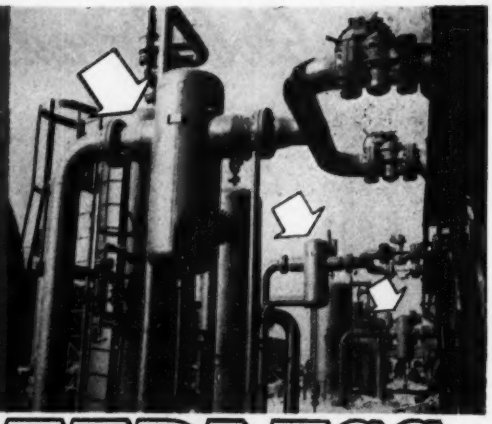

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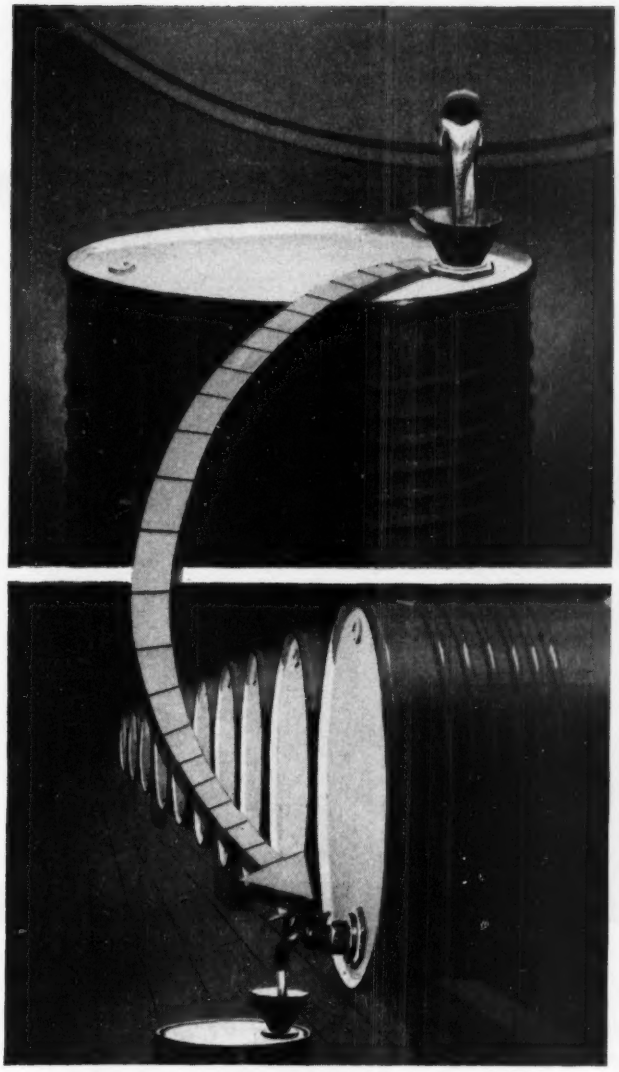

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USS STEEL DRUMS

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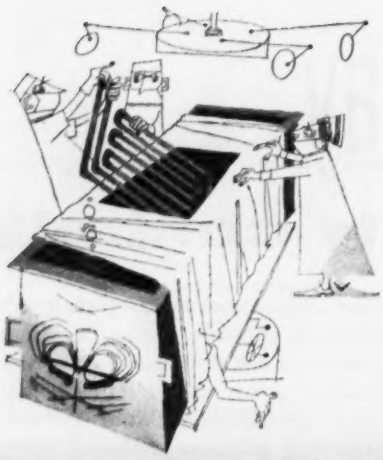

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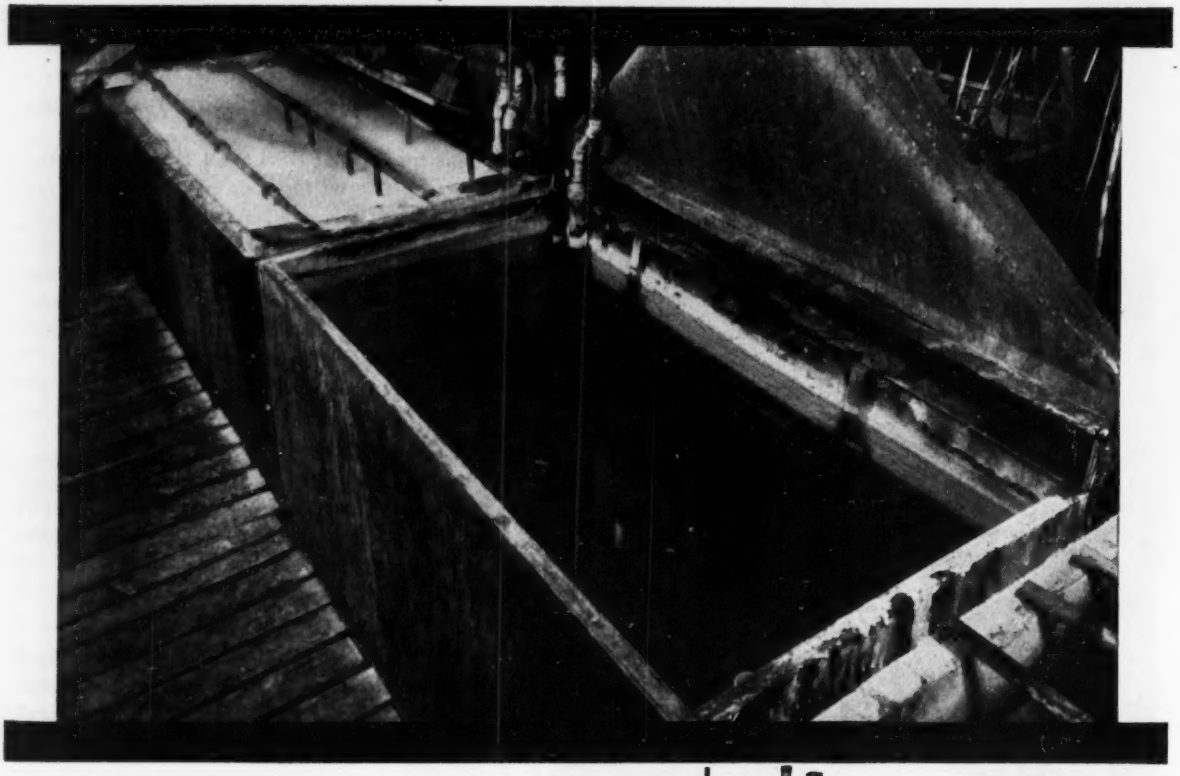
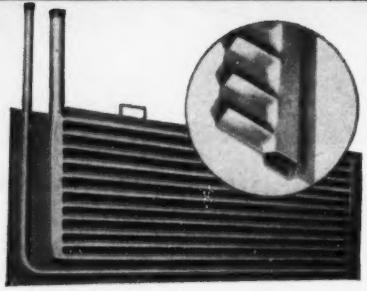
PLATECOILS *cure coil-itis* *

Addressograph - Multigraph Corporation has considerably reduced their process heating costs by changing to Platecoils instead of serpentine pipe coils for such processes as alkaline stripping, alkaline cleaning and chemical blackening of steel. Addressograph saved through lower initial costs, lower installation costs and a 50% reduction in maintenance costs. Much less space is consumed by the Platecoils and heating efficiency is greatly increased.

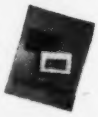


PLATECOILS *replace pipe coils for 50% of the cost*

* Coil-itis is the constant doctoring of wet processing tanks for pipe coil troubles. It can be cured easily by replacing pipe coils with Platecoils. Immediately, you will notice the difference as Platecoils put new life and profits into your heat transfer processes. They heat or cool 50% faster and take 50% less space in the tank. They save as much as 50% in initial cost and 50% in maintenance costs in addition to overcoming the limitations and operating difficulties of old fashioned and outmoded pipe coils.



Bulletin P61 shows how Platecoils are replacing pipe coils at a savings throughout industry. Send today for your copy.



Platecoil Division, TRANTER MANUFACTURING, inc., Lansing 4, Michigan

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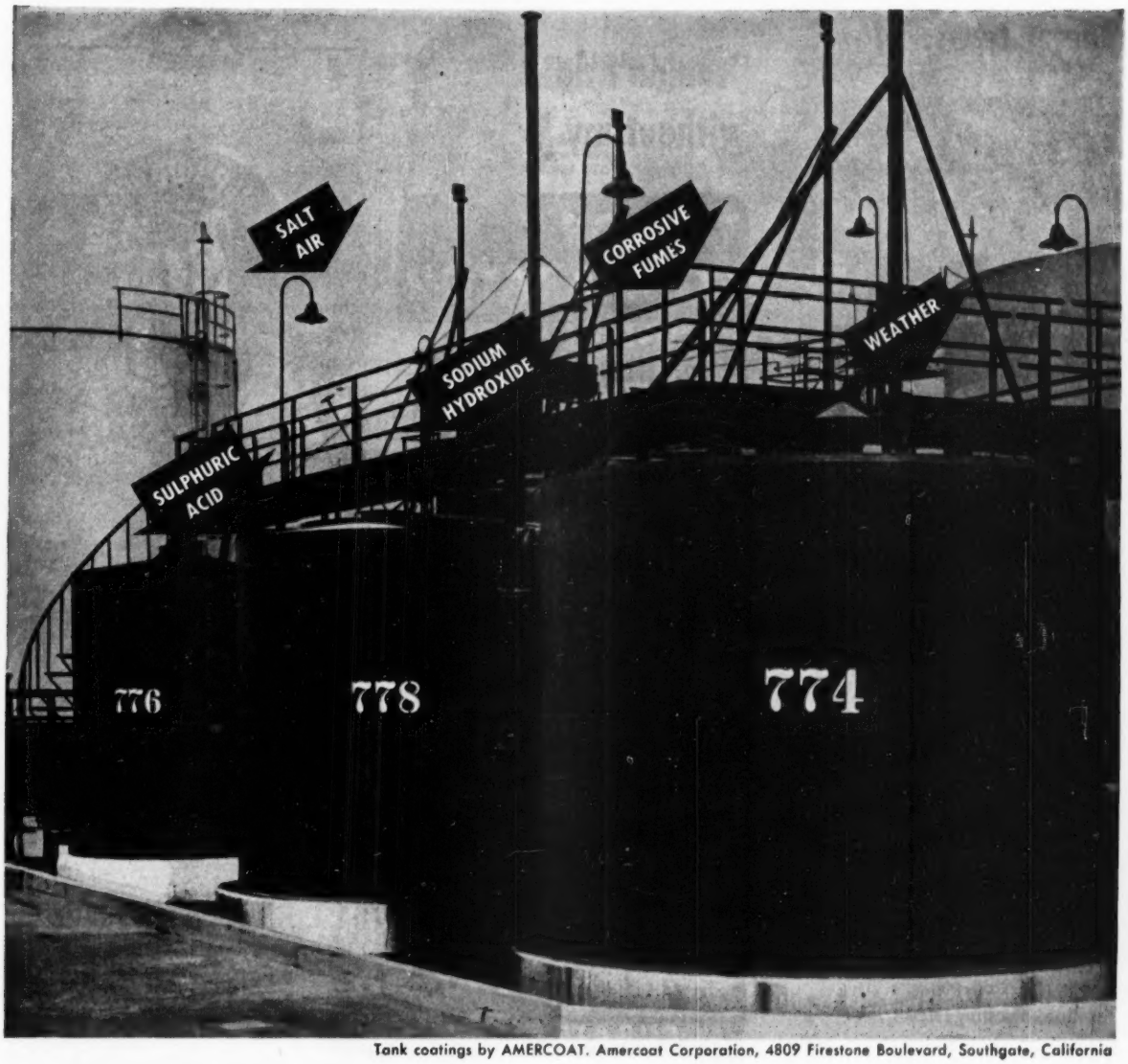

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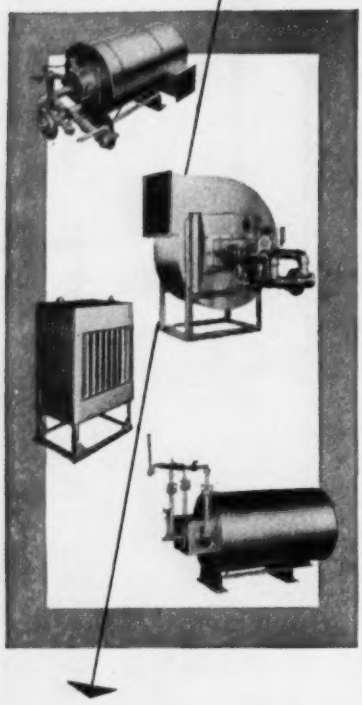

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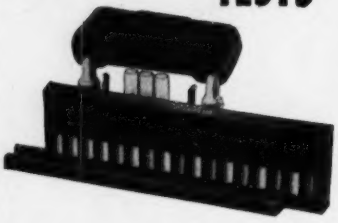

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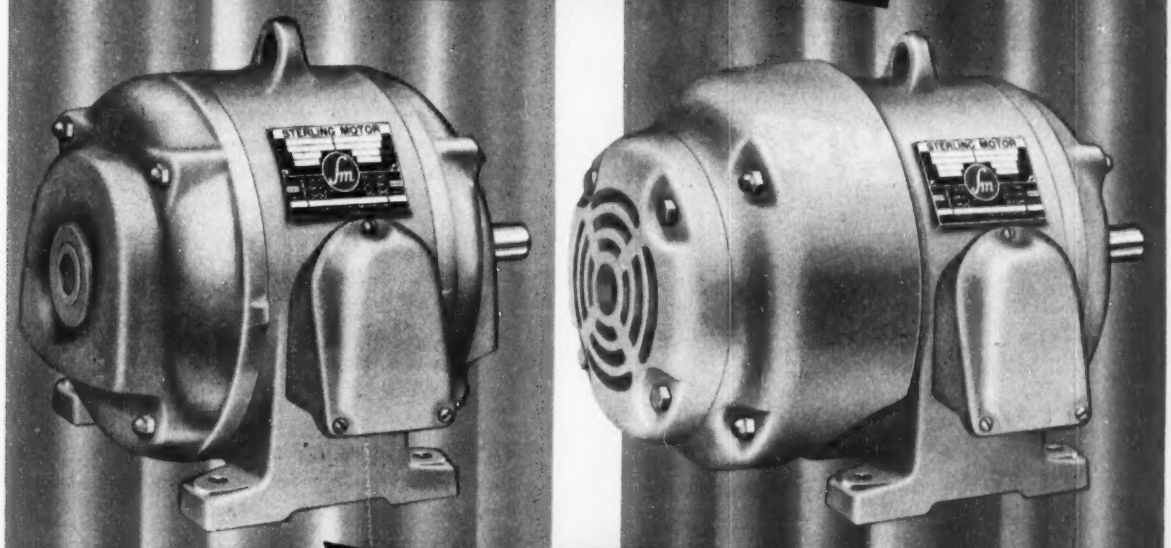

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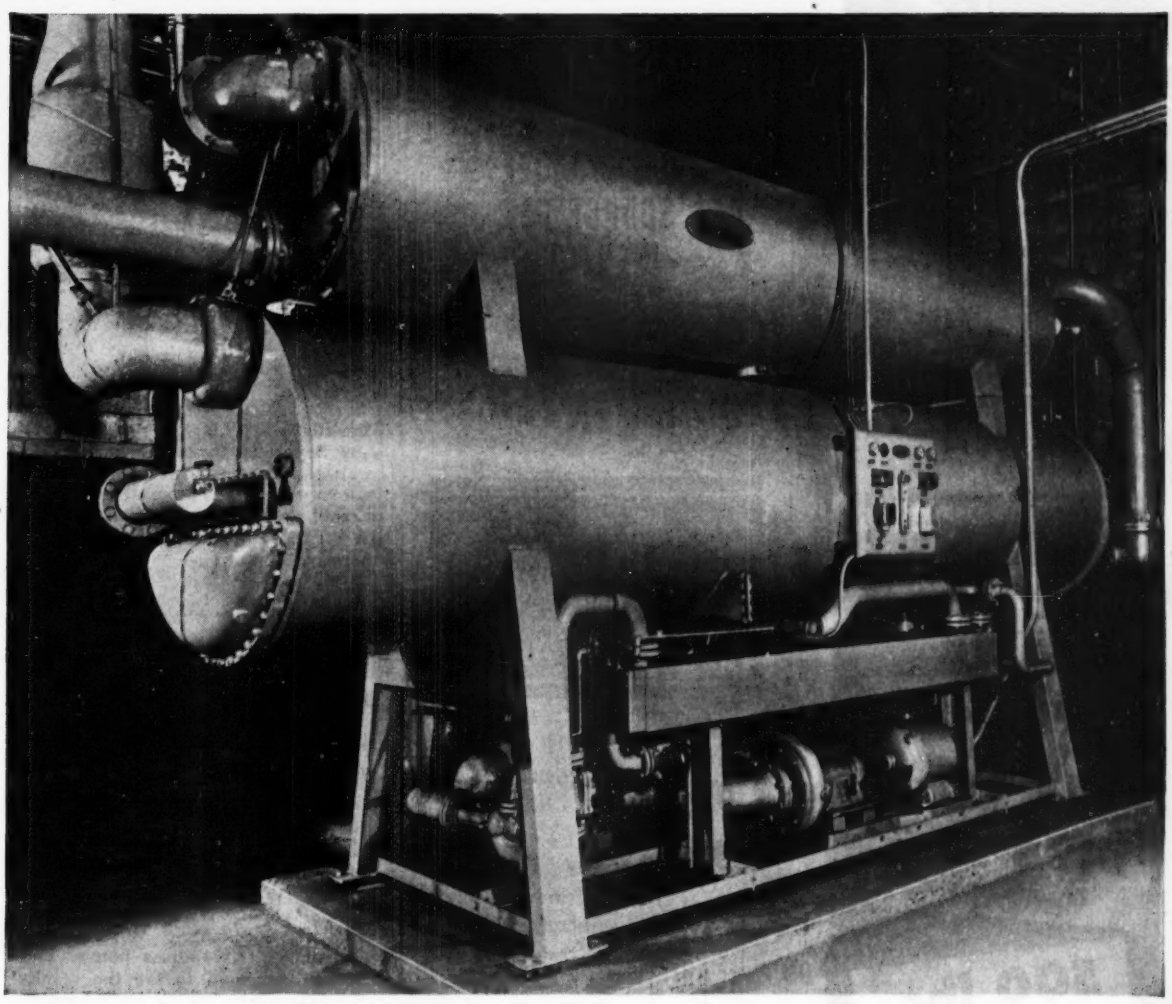

This 350-ton Carrier Absorption Machine is installed at the Joseph Horne Co. Suburban Store in Brentwood Borough, Pennsylvania.

Carrier Absorption Refrigerating Machine uses heat to cut cooling costs

—and AnacondA Cupro Nickel Tubes are again called on for economical quality performance in industry

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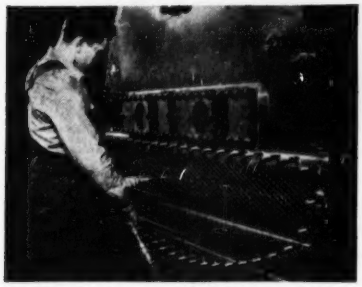

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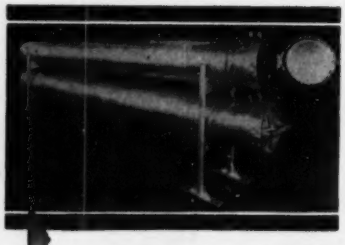

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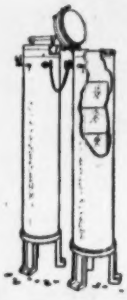

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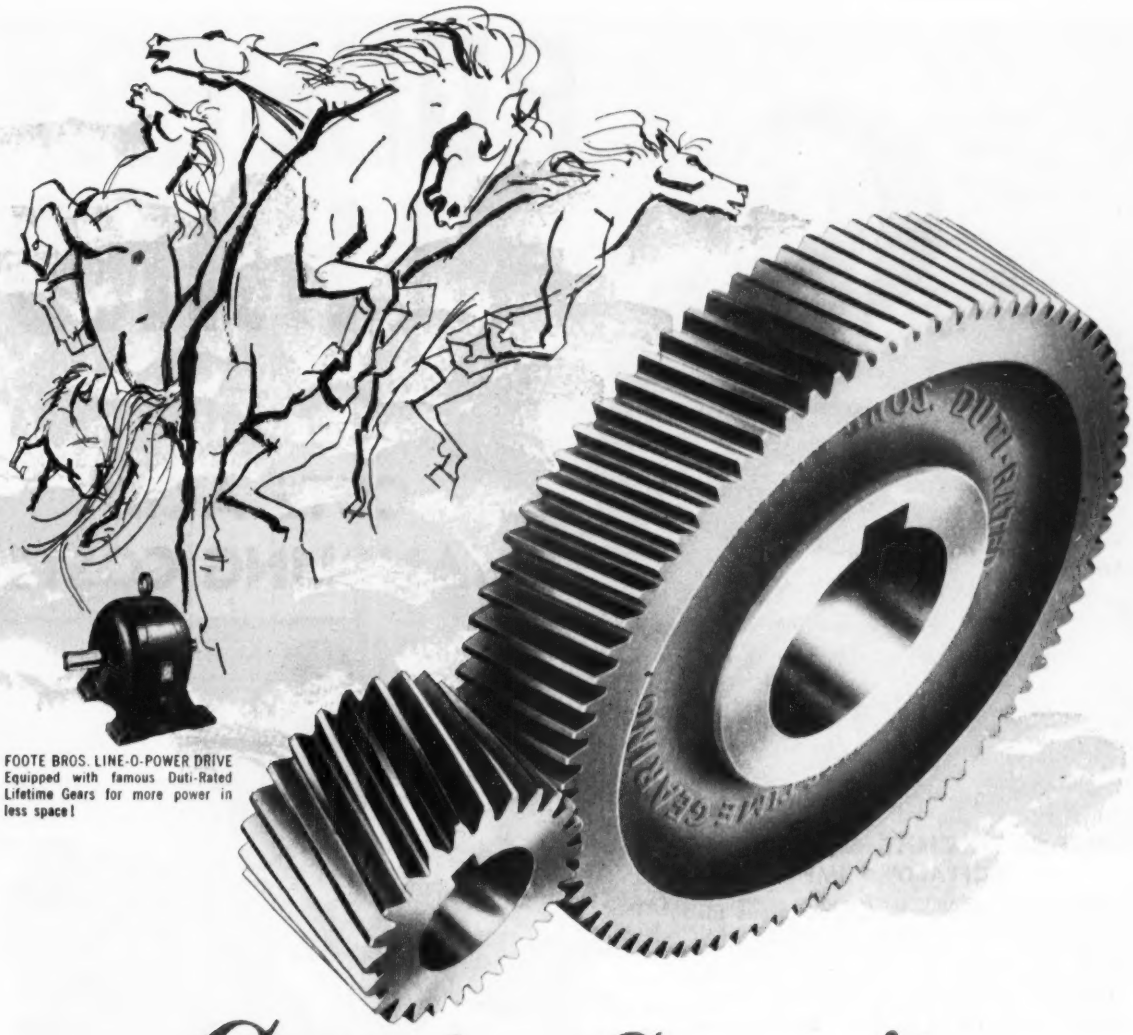

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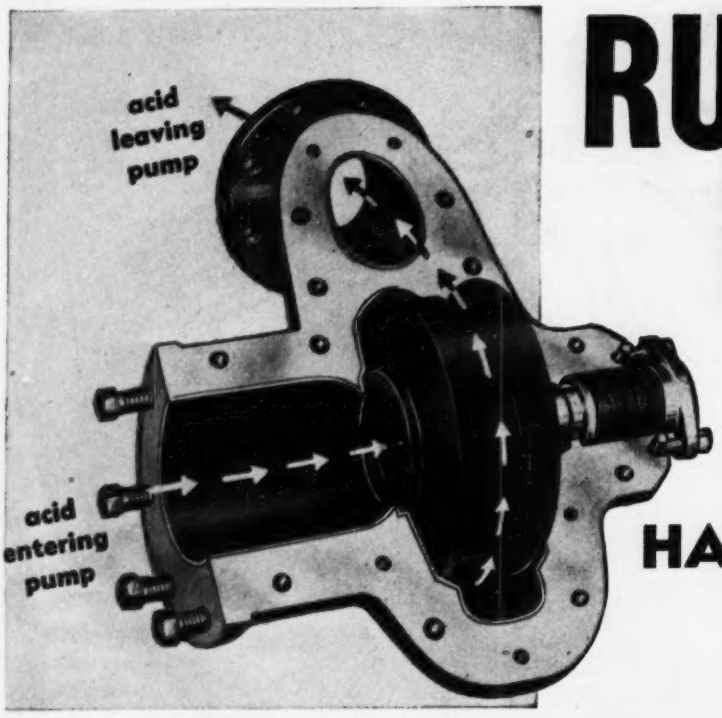

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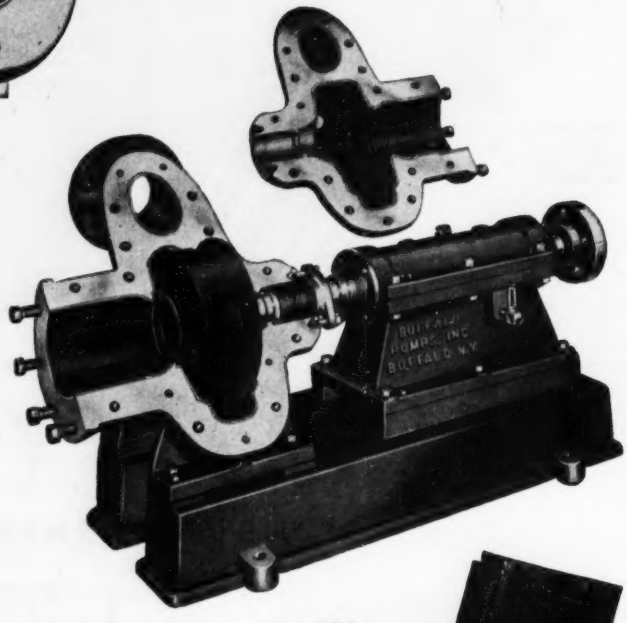

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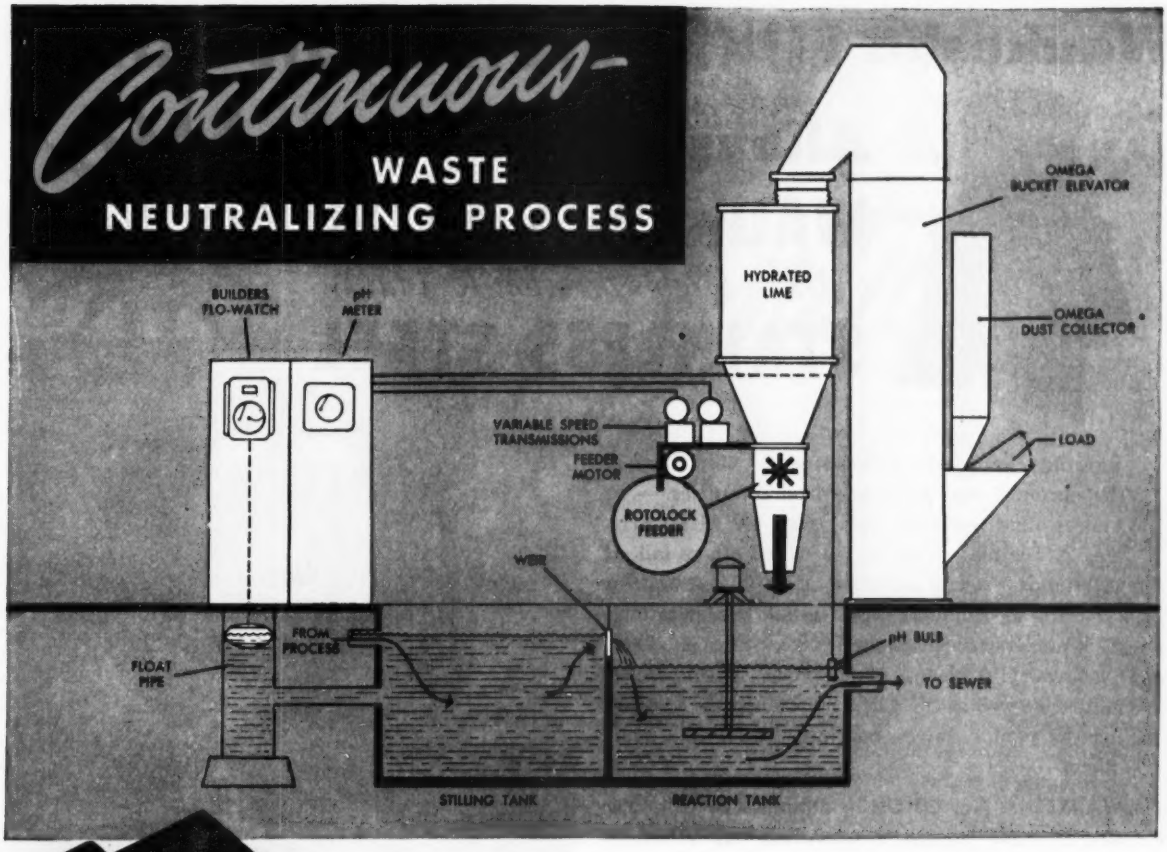

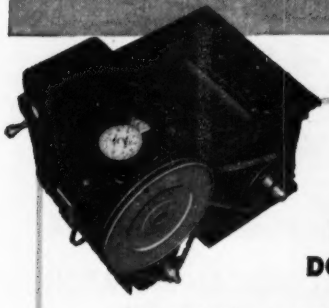

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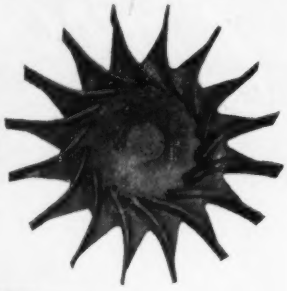

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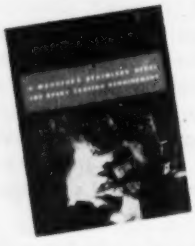

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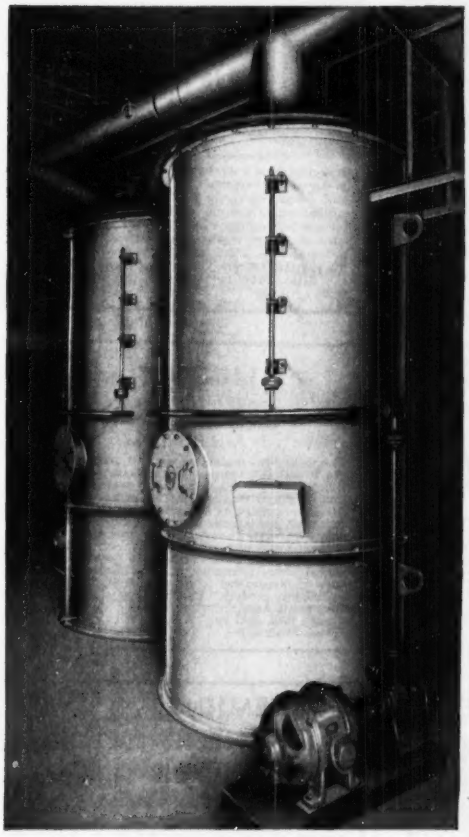

MAHON FOG-FILTERS AT WORK

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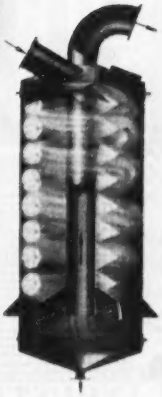
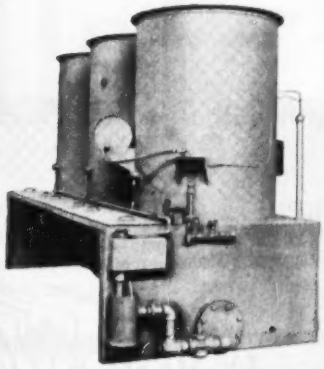
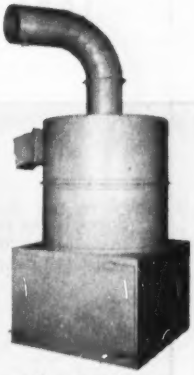


Fog-Filter

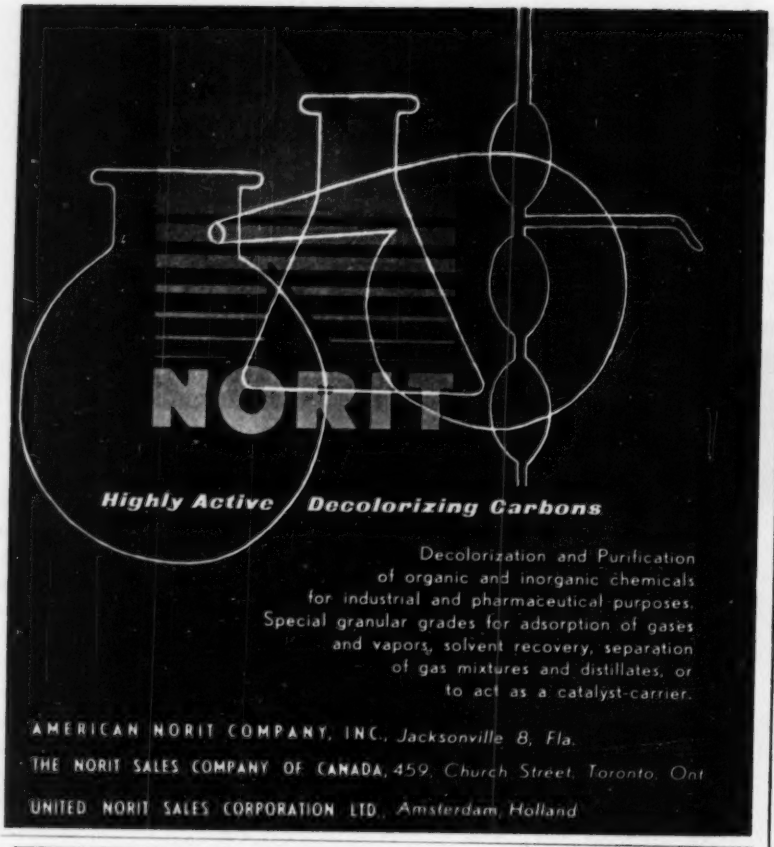


Hydro-Foam Dust Collector



Jet Trap Dust Collector

MAHON



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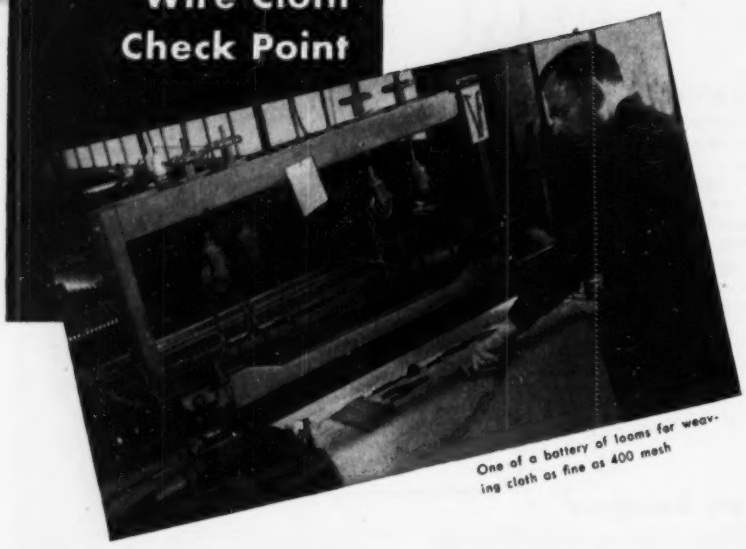

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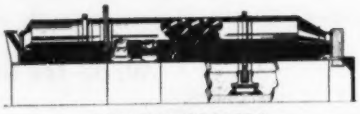

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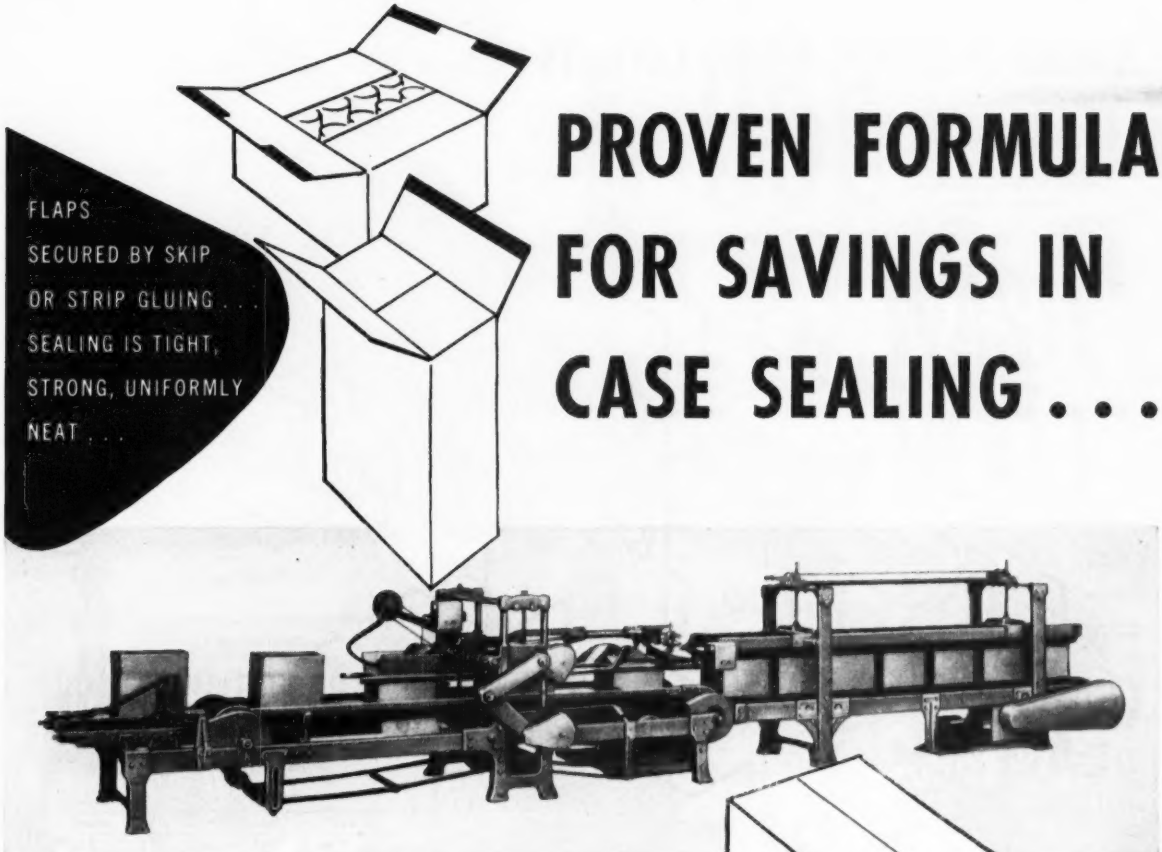

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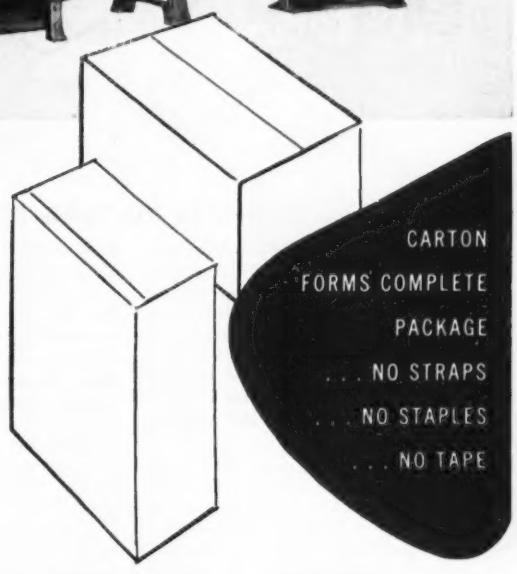

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JENKINS PRACTICAL PIPING LAYOUTS 72

Diagram by Huxley Madeheim, Consulting Engineer
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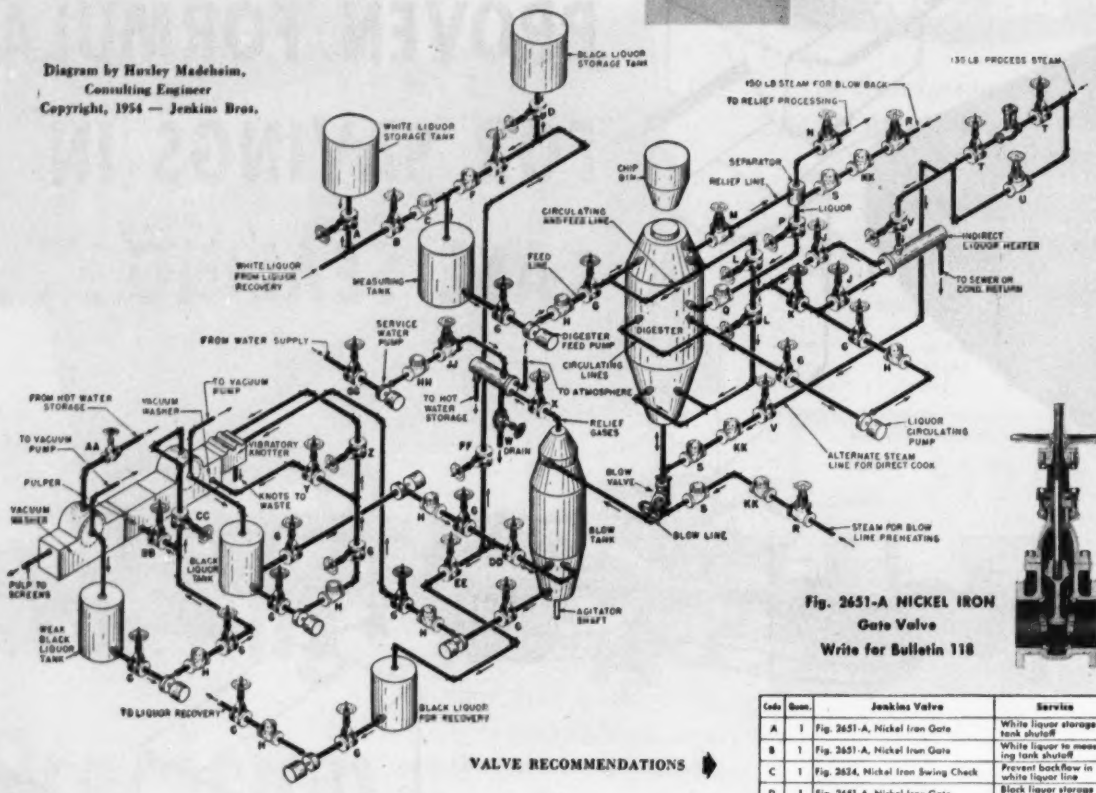

Fig. 2651-A NICKEL IRON Gate Valve
Write for Bulletin 118

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 2651-A, Nickel Iron Gate	White liquor storage tank shutoff
B	1	Fig. 2651-A, Nickel Iron Gate	White liquor to measuring tank shutoff
C	1	Fig. 2624, Nickel Iron Swing Check	Prevent backflow in white liquor line
D	1	Fig. 2651-A, Nickel Iron Gate	Black liquor storage tank shutoff
E	1	Fig. 2651-A, Nickel Iron Gate	Shutoff black liquor to measuring tank
F	1	Fig. 2624, Nickel Iron Swing Check	Prevent backflow in black liquor line
G	14	Fig. 2651-A, Nickel Iron Gate	Liquor Pump shutoff
H	7	Fig. 2624, Nickel Iron Swing Check	Prevent backflow through pump
J	2	Fig. 2651-A, Nickel Iron Gate	Liquor heater shutoff
K	1	Fig. 2651-A, Nickel Iron Gate	Liquor heater bypass
L	2	Fig. 2651-A, Nickel Iron Gate	Liquor circulating line shutoff
M	1	Fig. 1317, Stainless Steel Globe	Digester relief control
N	1	Fig. 1317-A, Stainless Steel Globe	Control flow of relief gas
P	1	Fig. 2651-A, Nickel Iron Gate	Shutoff liquor from separator
Q	1	Fig. 1331, Stainless Steel Swing Check	Prevent backflow to separator
R	2	Fig. 1040, Cast Steel Globe	Control steam flow
S	3	Fig. 1331, Stainless Steel Swing Check	Prevent liquor flow to steam line
T	2	Fig. 1009, Cast Steel Gate	Control valve shutoff
U	1	Fig. 1040, Cast Steel Globe	Control bypass steam
V	2	Fig. 1009, Cast Steel Gate	Steam shutoff
W	1	Fig. 106-A, Bronze Globe	Drain line control
X	1	Fig. 1309-A, Stainless Steel Gate	Blow tank vent shutoff
Y	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to washer pan
Z	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to knotter
AA	3	Fig. 106-A, Bronze Globe	Control water to wash sprays
BB	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to pulper
CC	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to wash spray
DD	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to blow tank
EE	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to recovery
FF	1	Fig. 2651-A, Nickel Iron Gate	Black liquor shutoff to storage
GG	1	Fig. 631-A, I.B.B.M. Gate	Service water pump shutoff
HH	1	Fig. 624, I.B.B.M. Swing Check	Prevent backflow through pump
JJ	1	Fig. 613, I.B.B.M. Globe	Control water supply
KK	3	Fig. 1025, Cast Steel Swing Check	Steam line check

How to plan a SULPHATE PULPING PROCESS SYSTEM

Chemical treatment begins when chips, conveyed to the digester, are cooked in an alkaline solution of sodium sulphide and caustic soda. The residual spent solution (black liquor) is used in subsequent processing, or is restored to its original state in a chemical recovery cycle. The resultant economy is an important advantage of the sulphate process.

The digester fluid is prepared by combining the alkaline solution, either new or recovered (white liquor), with black liquor from the digester discharge, in a predetermined ratio. This blended liquor is pumped into the digester simultaneously with the chips. A liquor circulating pump thoroughly agitates the mixture, and liquor drawn from the center of the digester bypasses the indirect liquor heater and is returned to the bottom of the digester. When the charge is completed, the digester is closed, and the cooking begins.

An indirect heater is used for cooking in sulphate pulping, generally, to prevent excessive dilution of the liquor. This layout also shows an alternate steam line for direct cooking.

When the cooked mixture is ready for removal, the blow valve is opened and the charge is transferred to the blow tank where it is washed and cooled.

In a series of vacuum washers, the pulp is forced onto revolving drums. As the drum revolves, the pulp is washed by sprays. From the last washer, it goes to the paper making process.

Black liquor collected from the first washer is stored for re-use in the digester, pumped to the blow tank for washing the pulp, or pumped to the recovery cycle for conversion to white liquor. This recovery process will be described in a later Jenkins Layout.

Jenkins Nickel Iron Gates and Checks with Stainless Steel Trim are recommended in this system, for valves in contact with black or white liquor.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To simplify planning, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17. Sold through leading Industrial Distributors everywhere.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Ask for Piping Layout No. 72.

JENKINS VALVES
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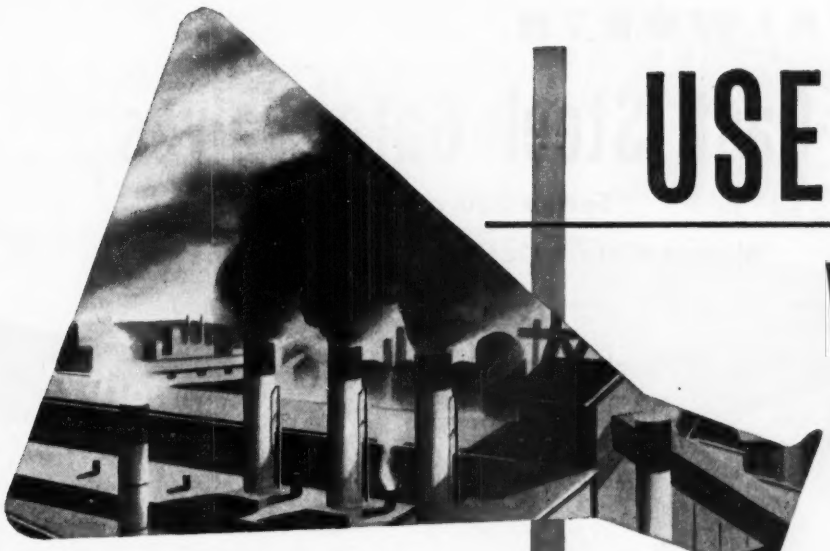
Jenkins Bros



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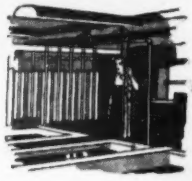

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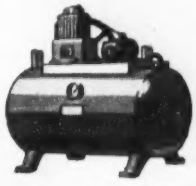
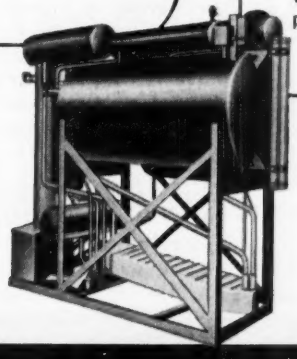


Increase capacity and improve performance of air compressors and internal combustion machines! The Water Chiller is compact, light; can be safely installed on almost any floor.



The Servel Water Chiller cooling system has no moving parts to wear. It is quiet and vibration-free. Light floor loading and freedom from vibration mean that no special foundations or braces are needed. Zone control is unusually easy. And operation (using waste heat, or steam from the cheapest source) is low in cost. Backed by a 5-year warranty. See your dealer or mail coupon for information and engineering co-operation.

Servel

the name to watch for great advances in

AIR CONDITIONING ✓ REFRIGERATION

SERVEL, INC., Dept. CE-54, Evansville 20, Indiana

Please send me complete information on Servel equipment for
☐ Air Conditioning, ☐ Process Cooling, ☐ Industrial Precooling.

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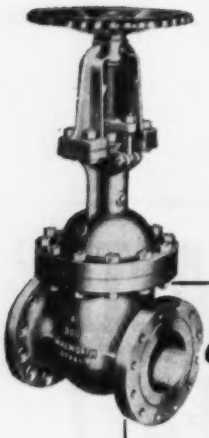
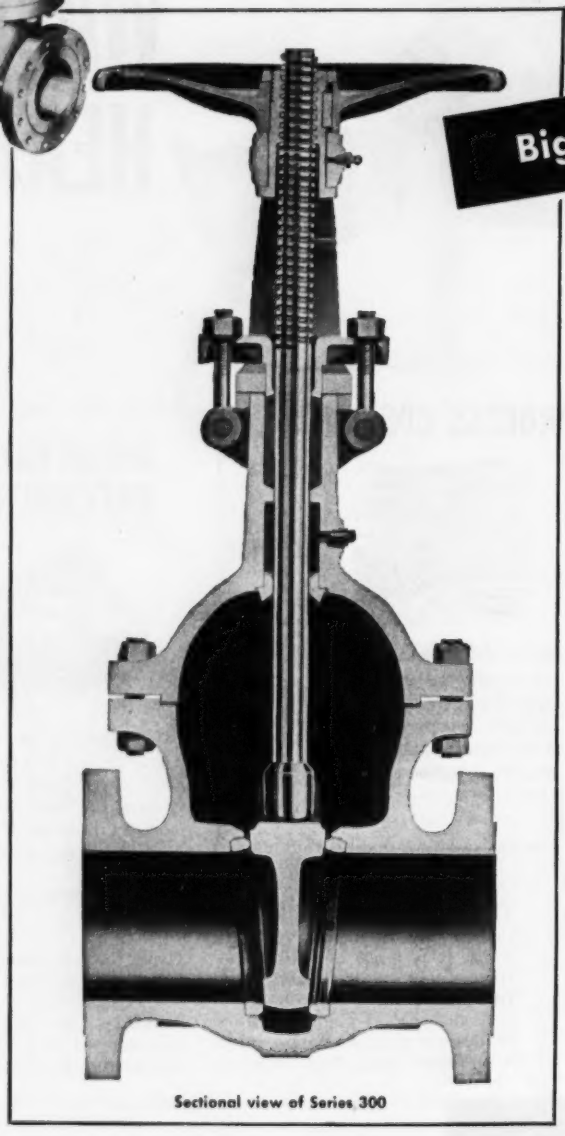
WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke





Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2" to 24") insure tightness and maximum packing life — costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion — they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated — not flange type. No recess exists at back of ring — hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

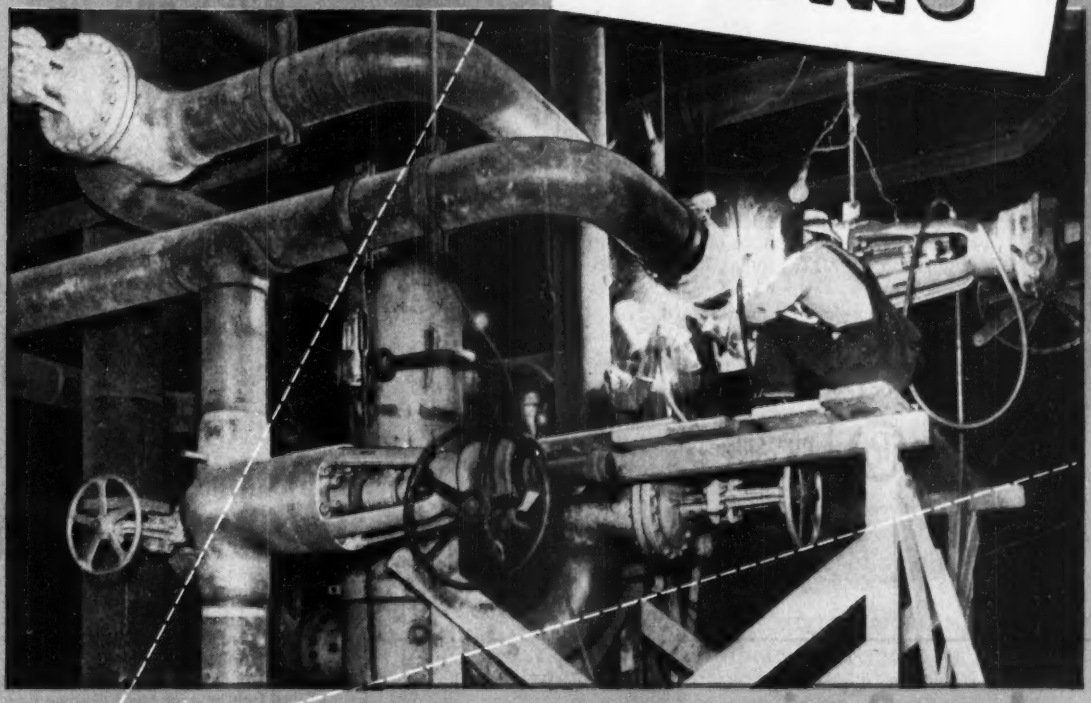
WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

THERE IS MUCH MORE TO MIDWEST PIPING



THAN MEETS THE EYE

Here you see carefully qualified Midwest welders erecting the boiler feed piping in a new public utility steam-electric generating station. What you don't see are the many other highly skilled men who contribute to the high quality of Midwest Piping.

First, there are the expert piping engineers who prepare the job for fabrication. They simplify the field work and make sure the difficult operations are done in the shop. And they often make suggestions that improve the design and reduce the cost of the piping.

Then there is the experienced shop organization (working with the most modern equipment) that delivers to the field subassemblies which are accurate in dimension, correct in alignment, thoroughly cleaned, heat treated when necessary, carefully inspected and tested . . . ready for erection at lowest cost. Both the shop and field supervisory personnel have come up through the ranks and know every phase of the operations . . . how to assure the customer the most for his money when he buys Midwest Piping.

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Main Office, 1450 South Second St., St. Louis 4, Mo.

PLANTS: ST. LOUIS, PASSAIC, LOS ANGELES, and BOSTON

SALES OFFICES: NEW YORK 7—50 CHURCH ST. • BOSTON 27—426 FIRST ST. LOS ANGELES 33—520 ANDERSON ST. • CHICAGO 3—79 WEST MONROE ST. TULSA 3—224 WRIGHT BLDG. • HOUSTON 2—1213 CAPITOL AVE.

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MIDWEST

PIPING FABRICATION and CONSTRUCTION

OFFERS YOU MANY BENEFITS

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PQ Soluble Silicates

METSO ANHYDROUS—technically pure anhydrous sodium metasilicate (U.S. Pat. 2,239,880). Over 50% sodium oxide is combined with soluble silica. Metso Anhydrous quickly penetrates dirt films, disperses solid dirt, emulsifies or saponifies animal, vegetable or mineral oils. Used for heavy-duty cleaning in metal industries, laundries, for clay washing and ore treatment.

METSO 200, highly concentrated sodium orthosilicate. Sodium oxide content approximately 60%, soluble silica, 29%. Popular for metal cleaning. Metso 200 solutions are good conductors of electricity. Conductance of 0.45% solution approximately .0121 mho at 70°F. and .0158 mho at 90°F.

Write for samples and more information for use in your operations.

Philadelphia Quartz Company
1125 Public Ledger Bldg., Philadelphia 6, Pa.

PQ® Silicates of Soda
METSO® DETERGENTS

For 100% Effective REMOVAL and RECOVERY of DUST and DRY MATERIALS anywhere in your plant

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Industrial Pneumatic Cleaning Systems

Permanently piped, stationary systems that pick up where present collectors leave off! On process operations or plant cleaning, Hoffman-designed systems provide big capacity for central collection of dust from several areas at same time. Sizes from 3 to 100 H.P., or larger to your requirements. Engineering survey, without obligation. Write for technical Bulletin A-939.

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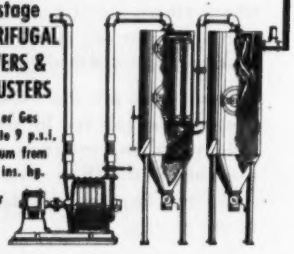
- **HEAVY-DUTY INDUSTRIAL PORTABLE VACUUM CLEANERS**
  4 Sizes — Write for Bulletins
- **Multistage CENTRIFUGAL BLOWERS & EXHAUSTERS**
  For Air or Gas from 1 to 9 p.s.i. or Vacuum from 2 to 12 ins. hg.
  Write for Bulletin A-932

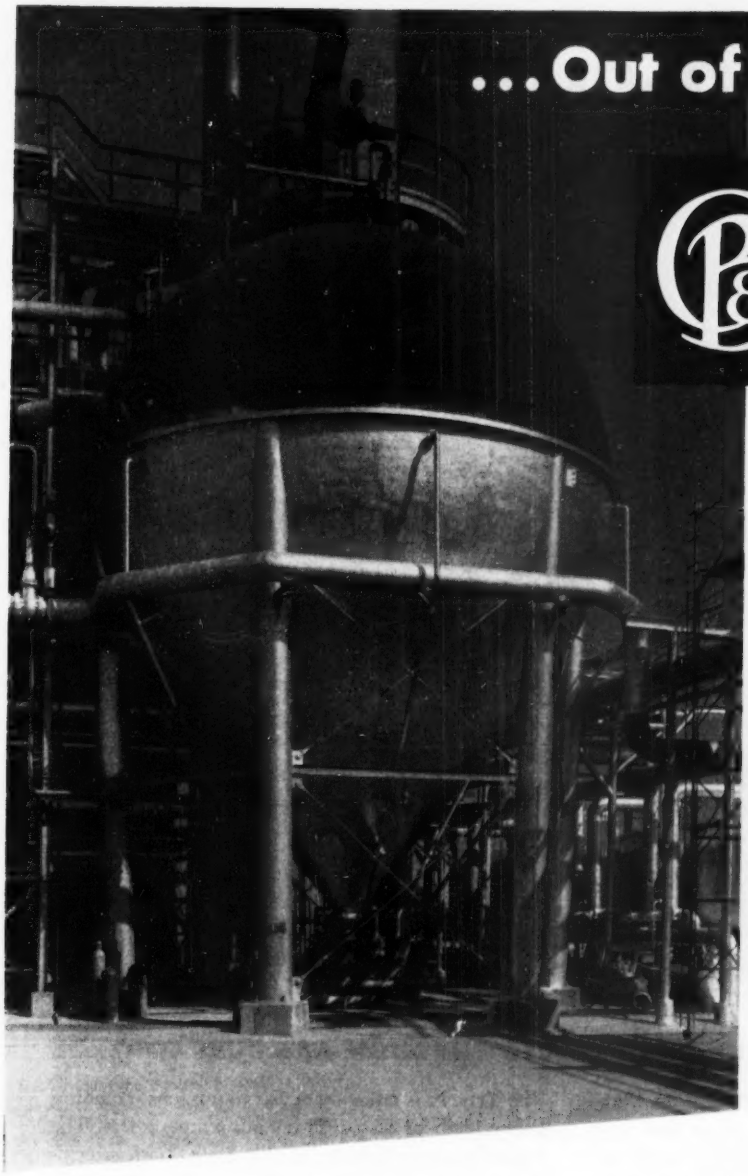


Air Appliance Division
Hoffman
U. S. HOFFMAN MACHINERY CORP.
Dept. CN 105 4th Ave., New York 3, N. Y.

As a Service to YOU

CHEMICAL ENGINEERING has expanded its Readers' Service so we may speed information to you . . . direct from the manufacturers of products described in this issue. Turn to the comprehensive Readers' Service section starting on page 486 with its handy, postage-paid reply cards.

Whether you're interested in one or many products, simply circle the desired items on the reply card and drop it in the mail. Prompt attention will be given your requests.



...Out of the Ordinary

C&I

INSTALLS 150,000 GALLON WATER SOFTENER TANK

Left: 150,000-gal. water softener tank built by Chicago Bridge & Iron Company. The vessel was designed by the Cochran Corporation.

● If you are in need of a special steel plate structure—something out of the ordinary like the 150,000 gallon water softener tank shown above—have Chicago Bridge & Iron Company build it. Pioneers and one of the world's largest builders of standard and special steel plate structures and storage tanks, CB&I is equipped to fabricate and erect steel plate structures to solve whatever special storage problems your products or supplies may present. We also have an experienced engineering department that will be happy to help solve your design problems.

CB&I regularly builds flat bottom storage tanks, elevated water tanks, Hortonspheres, Hortonspheroids, Horton Floating Roofs, and storage tanks of aluminum or stainless steel. We can also furnish carbon steel structures, clad or lined with corrosion-resistant metals.

Write our nearest office for estimates or quotations on any type of welded steel plate structure your operation may require. There is no obligation on your part.

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Los Angeles 17 ..... 1505 General Petroleum Bldg.
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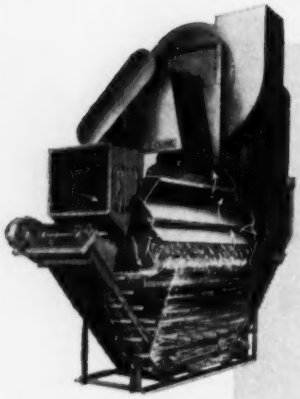
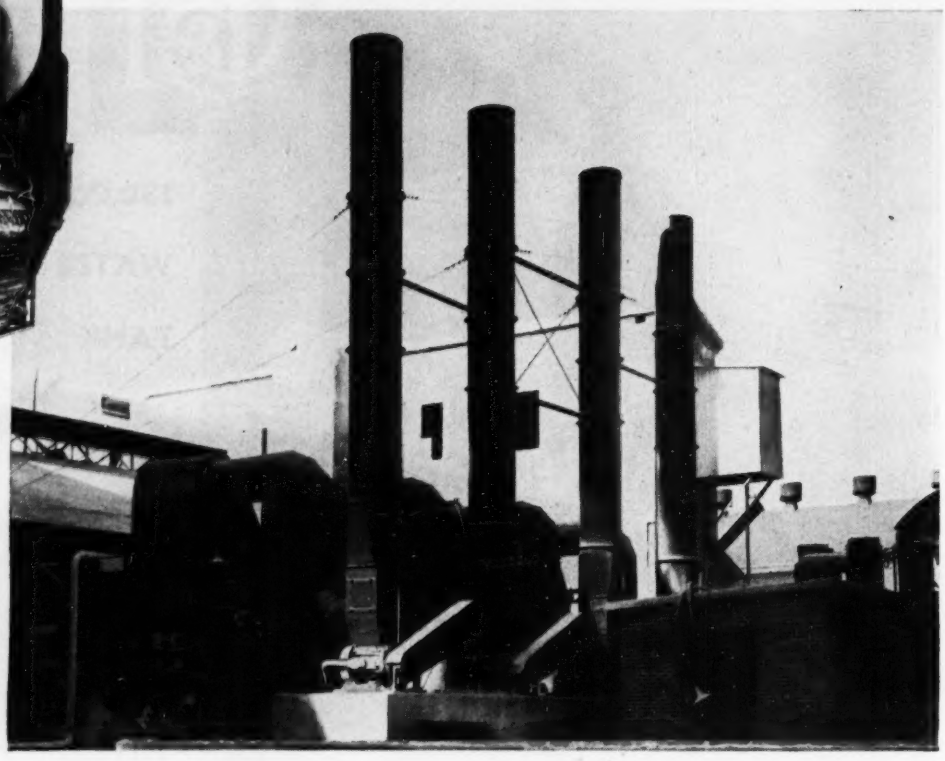
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

ROTO-CLONES Collect 5 Tons of Goodwill, Daily!



Type N ROTO-CLONE, Arrangement C—cut-away shows both distinctive water curtain and hopper equipped with automatic sludge ejector.



These four lime kiln stacks are served by four Type N ROTO-CLONES. Results? Note the cleanliness of the stack effluent.

LIME KILN STACK GAS NUISANCE SOLVED THROUGH AAF DUST CONTROL

Every day 5 tons of dust went up these four lime kiln stacks and came down on the plant and surrounding area! Certainly not a pleasant spot in which to work—definitely not a desirable community in which to live.

Here's how an alert management solved the problem. An AAF Dust Control System, consisting of 4 Type N ROTO-CLONES*, was installed. Today, instead of being "airborne," this 5 tons of lime dust winds up as a harmless sludge in a settling tank. Just one more example of many in the chemical, rock products and mining industries where ROTO-CLONE's high cleaning efficiency has eliminated a dust nuisance.

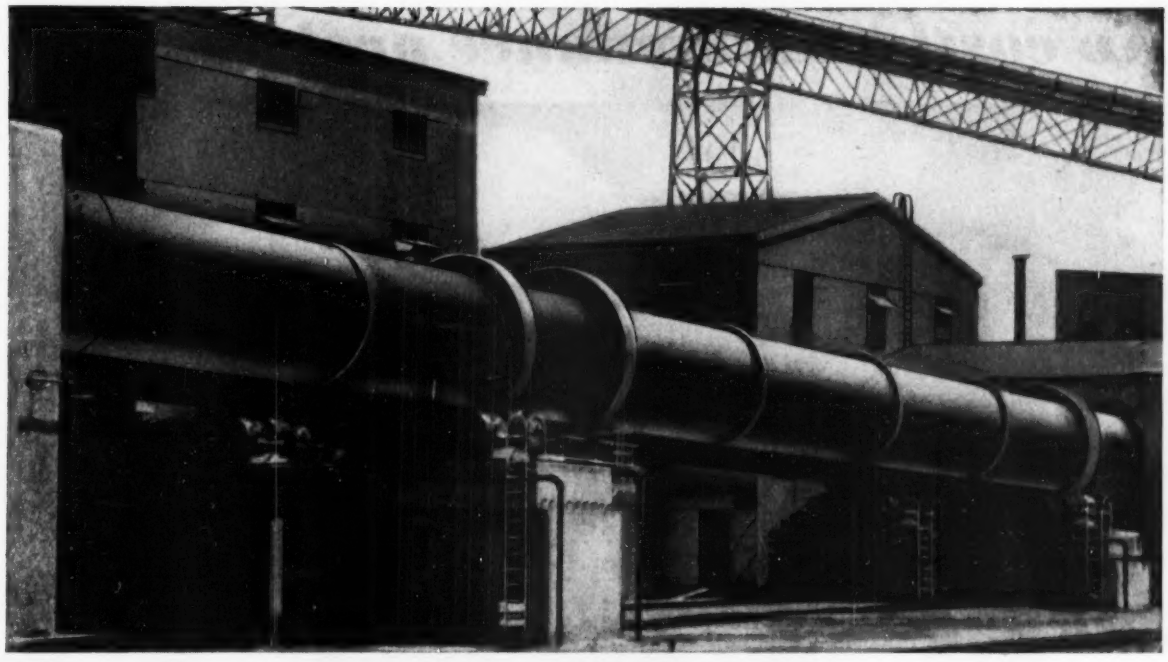
The Type N is tailor-made for tough jobs including heavy loads of fine dust at high temperatures. The high cleaning efficiency of this hydro-static precipitator results from the combined action of centrifugal force and a thorough intermixing of water and dust-laden air. It is unaffected by high temperatures, can't clog and collects the dust as a sludge for easy reprocessing or disposal.

Call your local AAF representative for complete facts on the Type N ROTO-CLONE or write for Bulletin No. 277. It costs fewer dollars in the long run to collect dust than complaints.

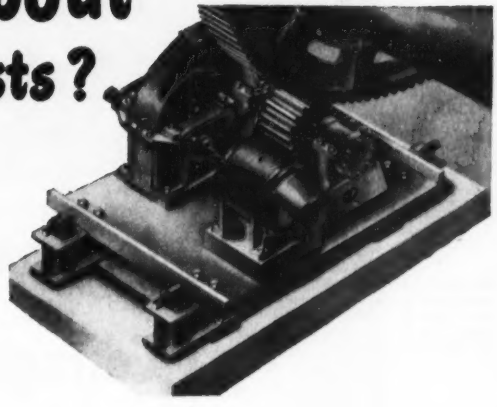
*ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

AAF American Air Filter COMPANY, INC.

326 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.



Are you concerned about high thermo-processing costs?



Then it's time to replace inefficient machines with Traylor Rotary Kilns

Traylor Rotary Kilns have many exclusive features which were developed over the past 50 years on the basis of field experience.

Solid cast steel floating riding rings, which are mounted on machined blocks, insuring a perfect fit. This eliminates uneven wear which causes weak spots that result in expensive maintenance.

Kiln drive is completely mounted on a sole plate which is fully adjustable as a unit to insure perfect alignment and easy adjustment of main gear and pinion.

Secondary air is utilized to obtain maximum heat efficiency from every B.T.U. This Traylor feature achieves amazing thermo-processing economies.

The success of Traylor Rotary Kiln design is best emphasized by the large number of customers who have returned time after time for additional Traylor Kilns. Send for Bulletin 115 which gives all the points of Traylor superiority.

a **Traylor** *leads to greater profits*

TRAYLOR ENGINEERING & MANUFACTURING CO.
641 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.

Send 8 page catalog on Traylor equipment for the process industries.

Name: _____
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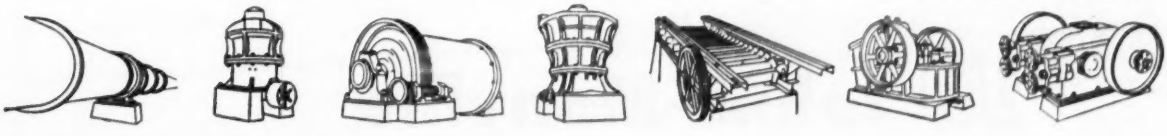
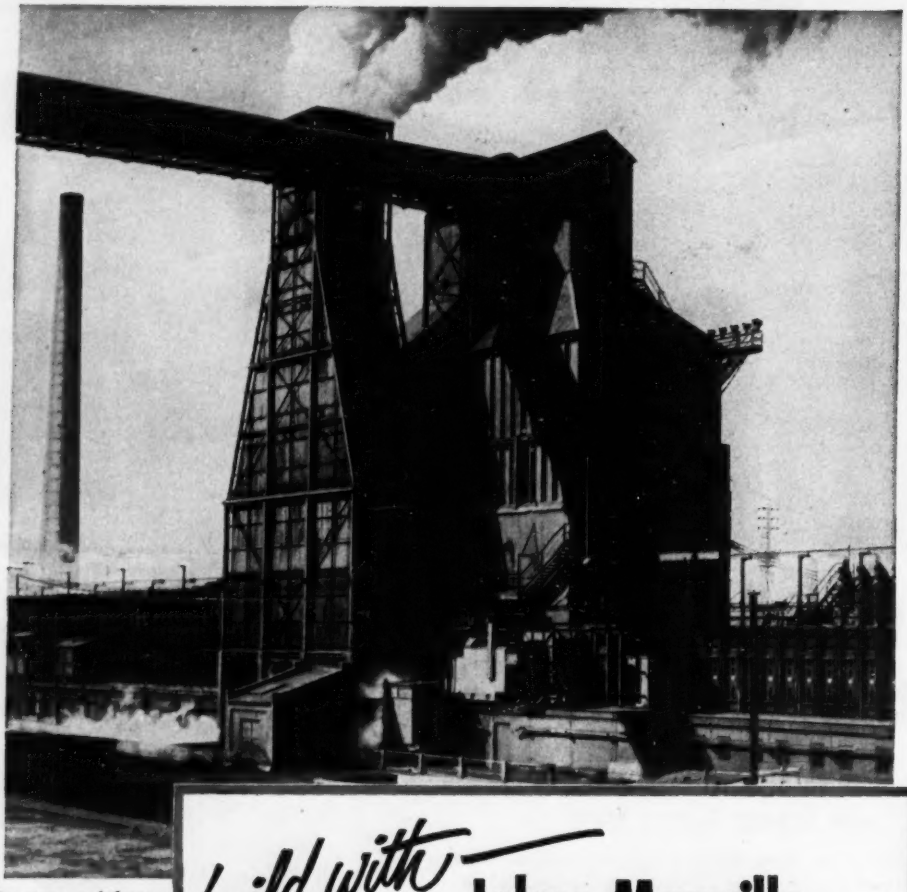
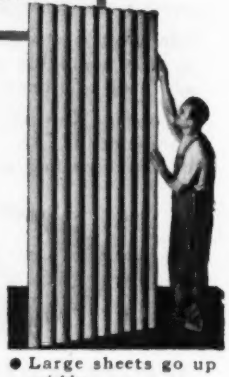


No costly maintenance problem here



So severe are the steam and fume conditions in this coke quencher station, that the heavy structural steel framing is on the *outside*, protected by J-M Corrugated Transite

build with Johns-Manville Corrugated Asbestos Transite



- Large sheets go up quickly
- Easy to fasten to steel
- Easy to nail to wood
- Easy to saw
- Easy to drill

For permanent, maintenance-free construction, plus protection from fire, rot and weather

YOU SAVE MONEY on construction and maintenance when you build with J-M Corrugated Transite®. Corrugated Transite comes in large sheets that require a minimum of framing . . . permit fast economical construction of maintenance-free industrial, commercial, institutional and agricultural buildings.

Made of asbestos and cement, Corrugated Transite is practically indestructible. It never needs paint or special treatment to preserve it . . . it's fireproof, rotproof and weatherproof. Corrugated Transite is also used increasingly for smart interiors . . . the streamlined corrugations and attractive shadow lines that give it such unusual architectural appeal for exteriors offer unlimited interior design possibilities.

Investigate Johns-Manville Corrugated Asbestos Transite and learn how you can build quickly and easily . . . have an attractive, long-lasting, trouble-free structure regardless of size or purpose. For complete details write Johns-Manville, Box 158, Dept. CE, New York 16, New York. In Canada write 199 Bay St., Toronto, Ontario.

JOHNS MANVILLE JM PRODUCTS **Johns-Manville**

PRESSURE COOKER for GAS

AN ACME-FABRICATED WELDMENT

This odd-appearing structure, made of type 310 stainless steel, is now hard at work in a catalytic cracking plant for one of the nation's largest utility companies. It's one more example of the many unusual pressure vessels being fabricated by Acme for chemical processing installations everywhere. Whether the vessel or component you need is large or small, irregular in shape or unusual in design, Acme's complete facilities — including the latest mobile X-Ray equipment — guarantee you exact adherence to your specifications as well as to your delivery schedules. Find out now why so many important companies specify Acme weldments . . . call us today.

STEEL • STAINLESS STEEL • EVERDUR • ALLOYS

A.S.M.E. U68-U69 Qualified Welders • A.P.I.-A.S.M.E. Approved
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Send us your blueprints for a prompt quotation and ask for our informative folder, ACME PLANNED WELDMENT FABRICATION.

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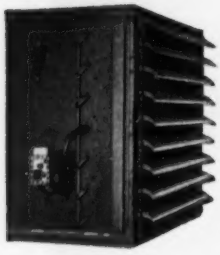
DIVISION of THE UNITED TOOL & DIE CO.
1054 New Britain Ave. • West Hartford 10, Conn.

National Representative TRANSMISSION EQUIPMENT CO., Inc.
441 LEXINGTON AVE., NEW YORK 17, N. Y.

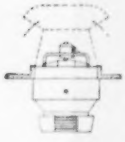
When air is exhausted from paint spray booths, from grinding, casting, chemical processing or other plant operations or is used in combustion, it must be replaced. Wing Fresh Air Supply Heaters provide the finest means of replacing exhausted air and supplying fresh air at the right temperature, winter and summer.

WING FRESH AIR SUPPLY HEATERS

require no extensive duct work. They are mounted in window or wall openings or below roof or monitor openings.



WING FRESH AIR SUPPLY HEATER
for Window or Wall Mounting



At left is shown Fresh Air Supply Heater for mounting in roof or monitor opening.

Write for Bulletin

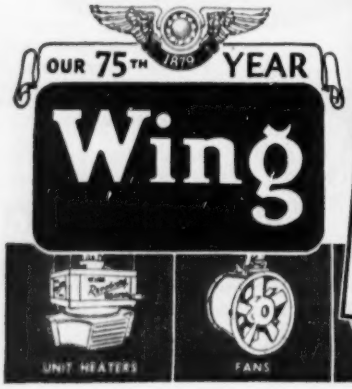
HOW THEY WORK. They draw in the outside air at prevailing outside temperature and pass it through multiple by-passes and heating elements which are always under full steam pressure.

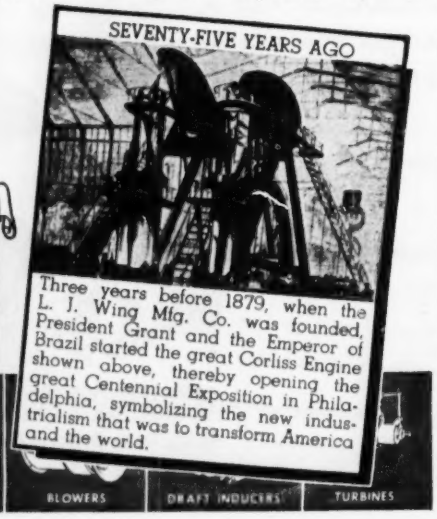
THEY CANNOT FREEZE. The heating coils can never freeze as they can where temperatures are controlled by throttling the steam supply.

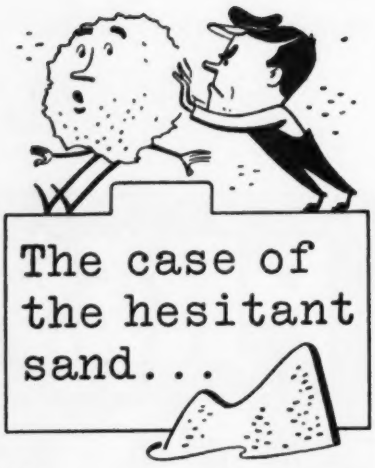
UNIFORM DISCHARGE TEMPERATURES. The discharge airstream is uniform in temperature because of Wing's unique design and construction which combine several alternating by-pass and hot air passages. The multiple thin layers of hot and cold air mix almost instantly assuring uniformly warm air at the outlet.

L. J. Wing Mfg. Co. 170 Vreeland Mills Road, Linden, N.J.

Factories
Linden, N.J. & Montreal, Canada
In Europe: Etab. Wanson,
Brussels, Belgium

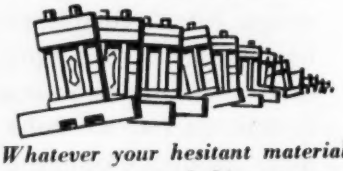



SEVENTY-FIVE YEARS AGO
Three years before 1879, when the L. J. Wing Mfg. Co. was founded, President Grant and the Emperor of Brazil started the great Corliss Engine shown above, thereby opening the great Centennial Exposition in Philadelphia, symbolizing the new industrialism that was to transform America and the world.
BLOWERS
DRAFT INDUCERS
TURBINES



Yes, a New England foundry really did have a case like this. As the sand started down through the overhead bins and hoppers, it paused uncertainly, sort of reared back and held up production something terrible.

Fortunately, the foundry superintendent called us for advice. In short order a battery of CLEVELAND vibrators were installed on the bins, and the sand hasn't hesitated ever since.

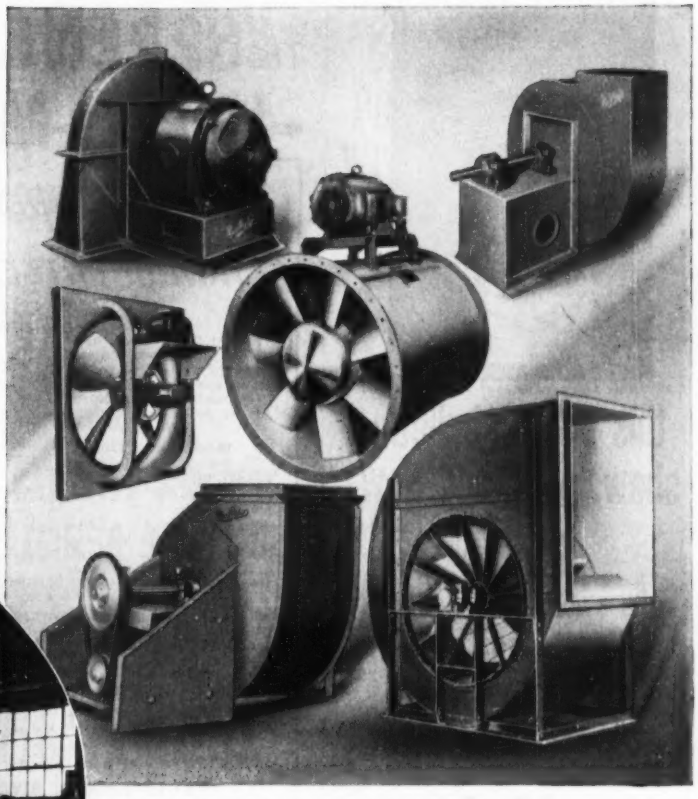


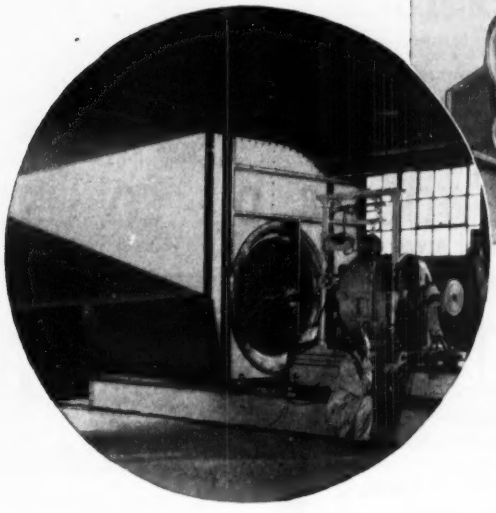
Whatever your hesitant material . . . cement, steel chips, ore . . . just tell us — or ask for our detailed literature.

AIR *and* ELECTRIC

2866 Clinton Avenue • Cleveland 13, Ohio

MAINTENANCE DIVIDENDS From Proper Fan SELECTION





In the "Buffalo" Test Room, engineers put fans thru every conceivable performance test. Continual improvement—better performance—lower fan maintenance costs—are the results. In the station at left, thrust, noise, and performance characteristics are checked.

If you keep records of maintenance costs, you'll already know that first cost can be of minor importance on some equipment.

On fans, for example, over a period of years, maintenance costs can be considerable. We believe, after seventy-six years' experience in air handling, that some of this excessive maintenance cost comes from improper selections of equipment.

"Buffalo" manufactures 20 lines of fans and blowers, for every service from residential kitchen ventilation to sub-zero airplane instrument testing—from 20 CFM to 600,000 CFM. We have, in our engineering files, almost every problem which AIR has been asked to solve.

We have the Engineering organization which produced, in 1914, the first edition of "Fan Engineering", ever since, the Bible of the air industry.

We do not hesitate to say, occasionally, "It cannot be done with present equipment."

Why not capitalize on this accumulated experience? Why not get the benefit of the Q* Factor that "Buffalo" builds into the fans, air cleaning and conditioning equipment, which our engineering sales representatives, in principal cities are ready to discuss with you? Their advice is impartial.

No obligation—and no regrets.

—The (Q) Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

501 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING	PRESSURE BLOWING AIR CLEANING	COOLING AIR TEMPERING	HEATING INDUCED DRAFT	FORCED DRAFT EXHAUSTING

this NEW bulletin shows why and how

KANE

GAS FIRED AUTOMATIC STEAM BOILERS

give you money-saving trouble-free operation

A copy of the new KANE Steam Boiler bulletin is yours merely for the asking. It gives a clear, concise story, with illustrations, on *how* and *why* the KANE Boiler for automatic gas firing . . . can be a real asset to *your* shop or plant. Of course, General Specifications and Standard and Special Construction details are included . . . yes, clean steam to 100 lbs. or higher pressure is at your instant command when you've installed a KANE *Vertical* Boiler . . . which takes up only a bare minimum of floor space.

Write, today, for *your* copy of this KANE Steam Boiler bulletin.

OVER FIFTY YEARS OF AUTOMATIC STEAM BOILER MANUFACTURING EXPERIENCE

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DIVISION OF S.T. JOHNSON CO.
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Sales Office: 108-22 Queens Blvd., Forest Hills 75, N. Y.

The EPPENBACH -HOMO-MIXER

NEW PRINCIPLE of OPERATION

1 *makes dispersions*
2 *homogenizes!*

"MORE THAN JUST A MIXER".

1. Turbine head near tank-bottom causes converging horizontal flow, carrying sedimentary material into close-fitting rotor vanes.
2. Inflowing "slurry" violently agitated at high velocity, projected up toward surface.
3. Submerged baffle plate deflects rising current toward tank sides, thence down toward bottom.
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5. Entire batch deflocculated, giving perfect dispersion.
6. No surface boil—no vortex—negligible air drawn in.

This mixer is built and operates on an entirely NEW principle. Ordinary mixers create a vortex in material, pull air into tank. The HOMO-MIXER draws only from the BOTTOM of the tank with no vortex. Write for details of this mixer—"the only one of its kind". Ask for Catalog No. 402.

Available in a complete range of sizes for laboratories and production plants. Capacities from 2 to 2,000 gallon batches; from ¾ to 25 H.P.

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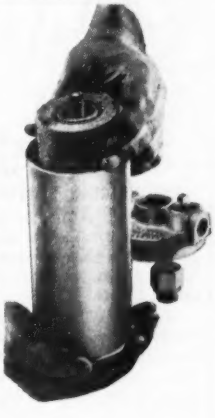
Here's how MICRO-KLEAN *halves your filter cartridge replacement costs*

ITS GRADUATED DENSITY IN DEPTH

INCREASES CAPACITY FOR DIRT ACCUMULATION IN CARTRIDGE

DOUBLES THE EFFECTIVE CARTRIDGE LIFE. That's how...

IT CUTS CARTRIDGE REPLACEMENT COSTS IN HALF!



In effect, every MICRO-KLEAN cartridge provides an almost infinite series of screens, ranging from relatively coarse on the outside down to 10 microns in the center.

Because of MICRO-KLEAN's graduated density, particles are trapped throughout the entire depth of the filter element, giving it twice the effective life of ordinary filter cartridges. Thus cartridge replacement costs are cut in half.

If you're looking for dependable, effective filtration at the lowest possible cost, Cuno's MICRO-KLEAN is your answer. You can get MICRO-KLEAN in densities of 10, 25, and 50 microns. M.3.D

CHEMICAL PLANTS SAVE VALUABLE PRODUCTION TIME WITH MICRO-KLEAN FILTERS

MICRO-KLEAN cartridges give longer effective operation

Shutting down fluid flow systems in order to clean filters or replace cartridges can be a costly problem. Here's how Cuno's long-lived MICRO-KLEAN filters will save you valuable production time by keeping these shut-downs to a minimum.

Fibre density of MICRO-KLEAN *increases* toward the discharge side of the cartridges, enabling it to trap contaminants throughout the *entire depth* of the filter element, instead of merely on the surface. This gives MICRO-KLEAN filters twice the effective life of ordinary filters which have the same fibre density throughout.

This graduated density in depth is made possible by Cuno's exclusive method of felting, which permits precision control of the cartridge structure. Also, each fibre of the MICRO-KLEAN filter is positively bonded in position by resin impregnation and polymerization for complete protection against channelling, rupturing, shrinking, or distortion.

The great porosity of MICRO-KLEAN's special cartridge permits high flow rates, often enabling you to speed up fluid processing. Installation and maintenance are simple; cartridges can be changed in a few seconds, as only one nut has to be removed.

That's why the MICRO-KLEAN will outperform any filter cartridge you have previously used. It will pay you to mail this coupon for full facts. M.3.21

Cuno Engineering Corporation
Dept. 1021D South Vine St., Meriden, Conn.

Please send me more information on MICRO-KLEAN for.....(fluid) and enclose your free filtration analysis form.

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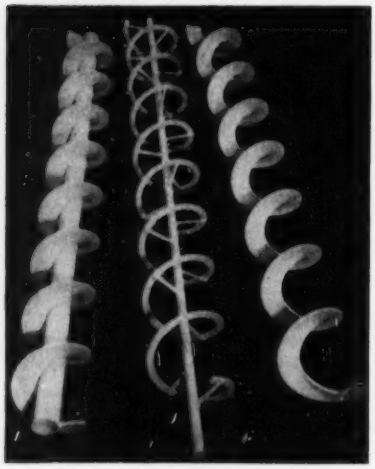

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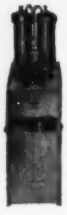

Penfield Dual-Column Demineralizer Model UL-60. Purity of effluent: 5 to 10 ppm. Flow rate: 75-100 gph. Dimensions: 2' x 2' x 4½'. Features self-contained stainless steel control cabinet in which regenerant tanks are stored.

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CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

Bridgeport BRASS CO. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. — IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Improved Corrosion Resistance of Condenser Tubes by Correct Alloying

Large-scale research into condenser tube alloys was launched in 1896, the year Bridgeport Brass began manufacturing the first Admiralty Condenser Tubes. Since that time, literally hundreds of metal combinations have been developed to meet a variety of corrosive conditions in modern power, processing and refining plants. Let's look briefly at the basic alloys.

The Brasses

Early condenser tubes standardized on brass of 70% copper and 30% zinc. Adding 1% tin to this mixture produced Admiralty alloy which checked to some extent the chief drawback of the original mixture, dezincification in fresh and salt waters. Later experiments showed that other elements added in small amounts to 70-30 brass had more or less the same effect. Those elements include arsenic, antimony, phosphorus, nickel, tungsten and aluminum.

Among the inhibitors, arsenic proved by far the most powerful. Additions of 0.027% arsenic to Admiralty and 0.21% arsenic to Muntz Metal (60% Cu, 40% Zn) cut dezincification by 66% and 80% respectively. Dezincification decreases also as copper content increases, reaching a low point in salt and fresh water with Red Brass (85% Cu, 15% Zn).

The low-copper brasses, on the other hand, are highly resistant to corrosive sulfide-bearing solutions and vapors encountered in petroleum refining and processing. Admiralty and Muntz Metal may corrode at 1/10th or less the rate of Copper or Red Brass.

The addition of aluminum to copper-zinc alloys markedly increases resistance to impingement corrosion of rapidly flowing or turbulent water. Dezincification in these alloys can be substantially reduced by the use of arsenic as an inhibitor.

Cupro Nickel Alloys

The most common copper-nickel alloy is 70% copper — 30% nickel. Widely used in marine condensers, 70-30 Cupro Nickel stands up well under fast-flowing sea water. When about ½% of iron is added to this mixture, resistance to impingement corrosion is considerably improved.

This alloy finds its chief application, however, in the handling of sodium hydroxide and other alkaline solutions, being the most resistant of the copper-base alloys to their corrosive action. In sulfide-bearing solutions, 70-30 Cupro Nickel has approximately the same corrosion resistance as Admiralty and Muntz Metal.

Other mixtures of Copper-Nickel (80-20 and 90-10), with higher additions of iron, can often replace the 70-30 alloy when nickel is in short supply.

The Bronzes

The most important of the bronzes used in condenser tubes is Arsenical Aluminum Bronze (Duronze IV), composed of about 95% copper and 5% aluminum plus arsenic. It is notably superior for fresh and brackish water corrosion and brines with low concentration of sulfides, but not recommended for ammonia-contaminated fluids.

Combinations of copper, tin and small amounts of phosphorus (to 0.35%) show good immunity to flowing sea waters and most acids, except hydrochloric.

Copper-Silicon alloys rank with plain copper in corrosion resistance, and are chosen over copper chiefly for mechanical properties and weldability.

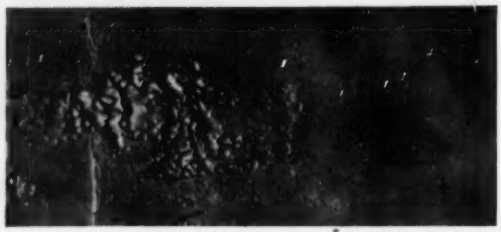
Duplex Tubes

Many applications of condensers and heat exchangers are troublesome because the tube is attacked simultaneously inside and out by entirely different types of corrosive media and few single metals can withstand these double attacks. The answer is found in Duplex Tube, a tube of one metal which encases another tube of a different metal, each picked to meet one particular corrosive condition. Combinations of metals in Duplex run into the hundreds — Admiralty, Muntz Metal, Cupro Nickel, Aluminum Brass, etc., coupled with steel, nickel, aluminum, Monel, lead, plus many others.

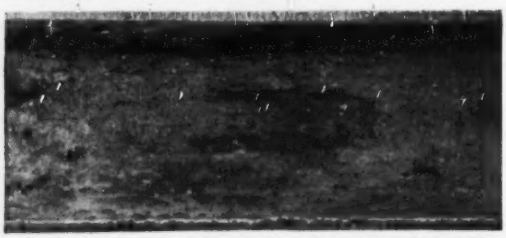
Continuing Research

These alloys and many others developed to meet a variety of applications are the result of our continuous research program. Bridgeport Technical Service, with its experienced engineers and fully equipped laboratories, is ready to help solve your condenser tube problems. Call any one of the Bridgeport Sales Offices, located in principal cities to take advantage of this service. Stocks of Bridgeport condenser and heat exchanger tubes are carried in Beaumont, Texas; Ponca City, Okla.; Los Angeles and San Francisco, Calif., for your urgent needs.

(1790)



Results of impingement attack on inlet end of Admiralty Condenser Tube, (cut open, flattened and magnified 1½X).



A section of Bridgeport Aluminum Brass Tube, (magnified 1½X), in the same service, showing absence of impingement corrosion.

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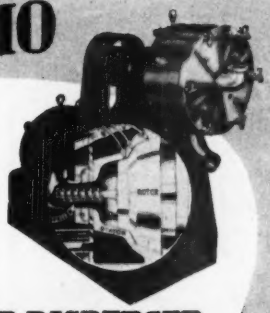

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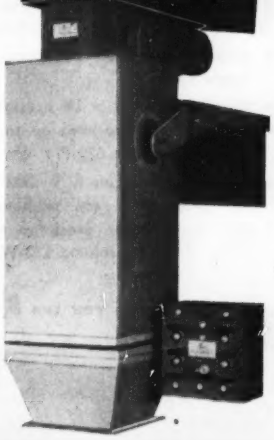

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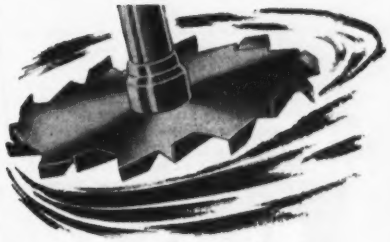

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The Cowles Dissolver mixes your batch thoroughly without using baffles—thanks to its high speed and the speed differential between the rotary motion of the batch and the impeller.

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3 NO PLUGGED-UP HOLES

The Cowles Dissolver has no slots or holes that can become plugged up with large chunks or balls. This makes cleaning faster, easier.

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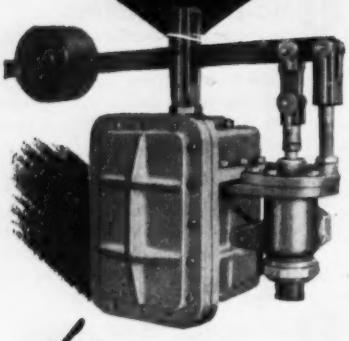

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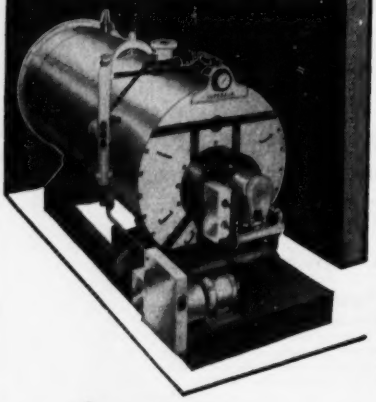

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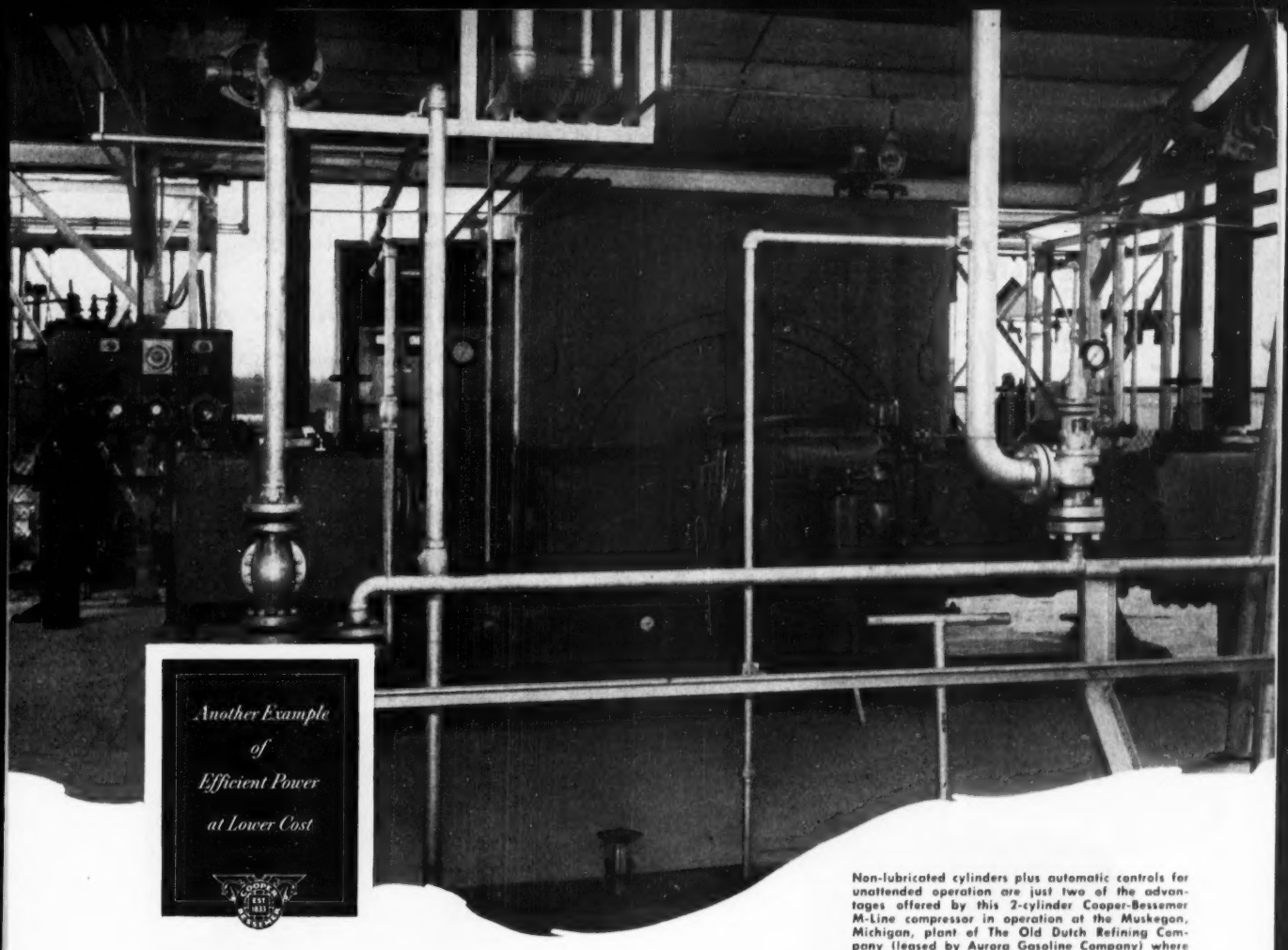

Non-lubricated cylinders plus automatic controls for unattended operation are just two of the advantages offered by this 2-cylinder Cooper-Bessemer M-Line compressor in operation at the Muskegon, Michigan, plant of The Old Dutch Refining Company (leased by Aurora Gasoline Company) where the UOP Platforming process is in use.

"HYDROGEN COMPRESSES CLEAN"

... with Cooper-Bessemer's non-lubricated cylinders

RECYCLING millions of cubic feet of hydrogen a day for the UOP Platforming of low-octane gasoline, demands continuing efficiency from a smooth working compressor that will not contaminate the recycle hydrogen. That is one of the reasons why The Old Dutch Refining Company, leased by Aurora Gasoline Company, recently installed a 2-cyclinder Cooper-Bessemer FM compressor in their modern plant in Muskegon, Michigan.

To avoid contaminating hydrogen with oil in the recycle gas, Cooper-Bessemer successfully developed a non-lubricated compressor cylinder.

Operating against micro-smooth hardened cylinder liners, these 8" diameter carbon pistons require no lubrication whatever. With a mirror finish, the cylinder bores reveal no excessive wear.

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New pump efficiency 79%	**25.6 BHP**
	3.3 BHP Saving

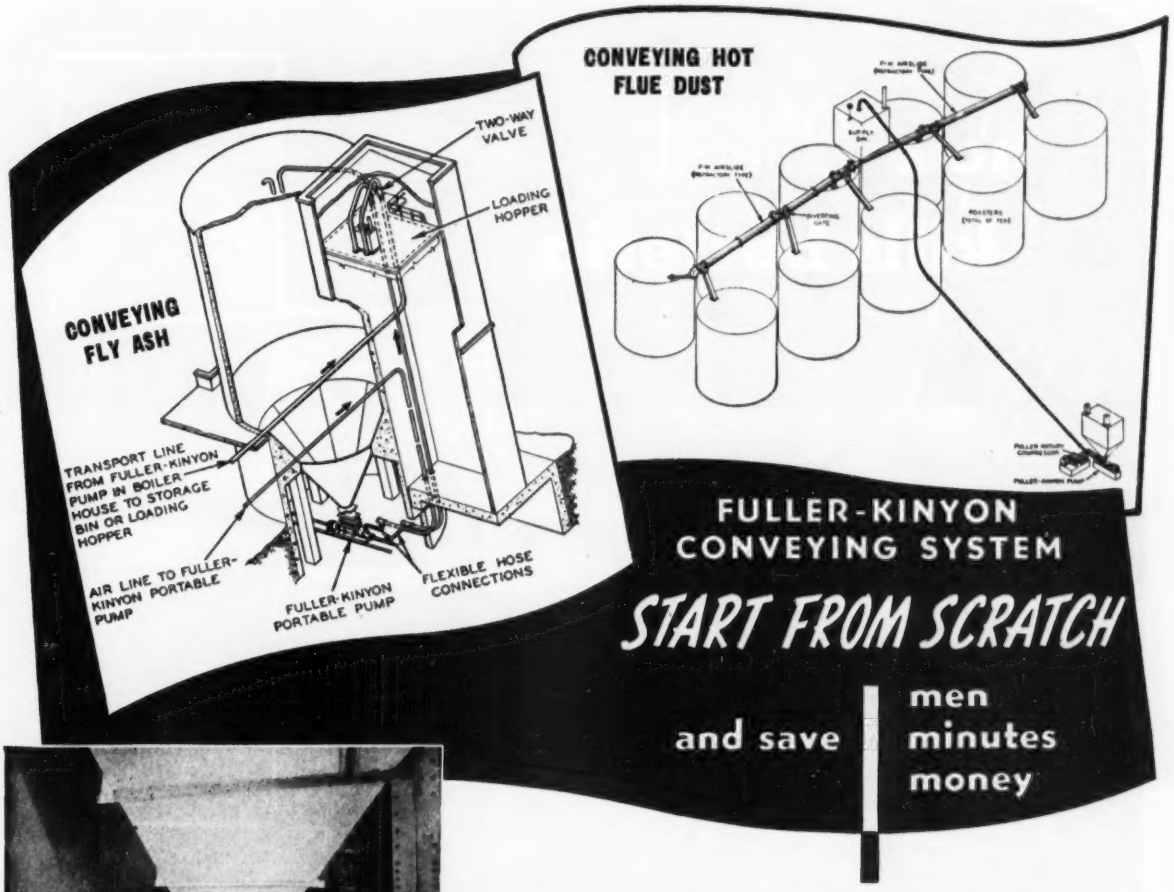
On the basis of 1¢ per KWH, the 3.3 BHP saving for a 6000-hour year (approximately 16 hours per day) amounts to $150. This saving, capitalized in 4 years at 4% adds up to $630. Yet the price of the new pump that saves $630 is only $438.

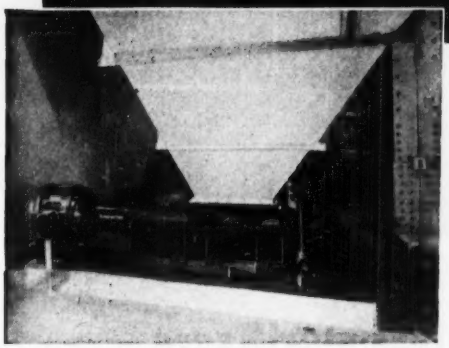
What would the pump replacement profit be in your particular case? Your De Laval representative can tell you exactly — in dollars and cents — as soon as he has the basic facts on your present installation. Call him in today or write to De Laval for Pump Fax Bulletin which includes a valuable "power-savings" chart.

DE LAVAL *Pumps*

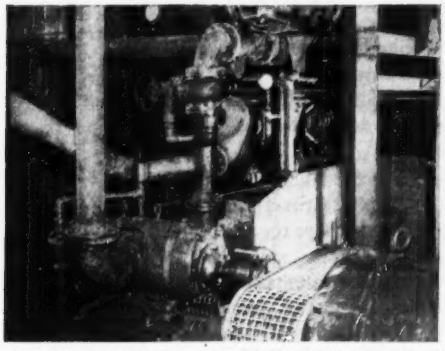
DE LAVAL STEAM TURBINE COMPANY
803 Nottingham Way, Trenton 2, New Jersey

DL-237A





Fuller-Kinyon System handling fly ash in a large central-generating station, from boilers to storage, storage to loading hopper. See drawing upper left.



Fuller-Kinyon System handling hot flue dust from Cottrell precipitator collecting hoppers to supply bin. F-H Airslides convey and distribute uniformly to roasters. See drawing upper right.

The best way to solve any problem of conveying dry pulverized materials is to "Start from Scratch." Get all the facts on pneumatic conveying systems while you are still in the planning stage ... either when building a new plant or modernizing an old one. Pneumatic conveyors permit economy and convenience in location of buildings and production equipment without the restrictions or straight-line limitations of mechanical conveyors. The layout of the system can be designed to meet the specific requirements of the job, to conform exactly to local conditions, to insure minimum cost for erection, maintenance, and supervision.

Right there is where Fuller comes into the picture. As engineers and builders of four basic types of pneumatic conveying systems, Fuller is able to provide the exact system best suited to individual requirements. Shown are two Fuller-Kinyon Conveying Systems—one for handling fly ash from boilers, the other for hot flue dust from Cottrell precipitators.

Fuller-Kinyon Systems have many advantages: conveying lines can be located anywhere—underground; suspended on simple hangers overhead; vertically; around corners; over long distances; and to practically any number of delivery points. There are no mechanical or explosion hazards. Conveying is clean, fast, and at minimum cost per ton of material handled.

We invite you to have Fuller engineers make a study of your plant plans—investigate conditions and the material to be handled. Then they can make recommendations as to the system best adapted to your needs—enable you to save time, money, and material by having both plant and system built at the same time. To consult them places you under no obligation.

FULLER COMPANY—CATASAUQUA, PA.

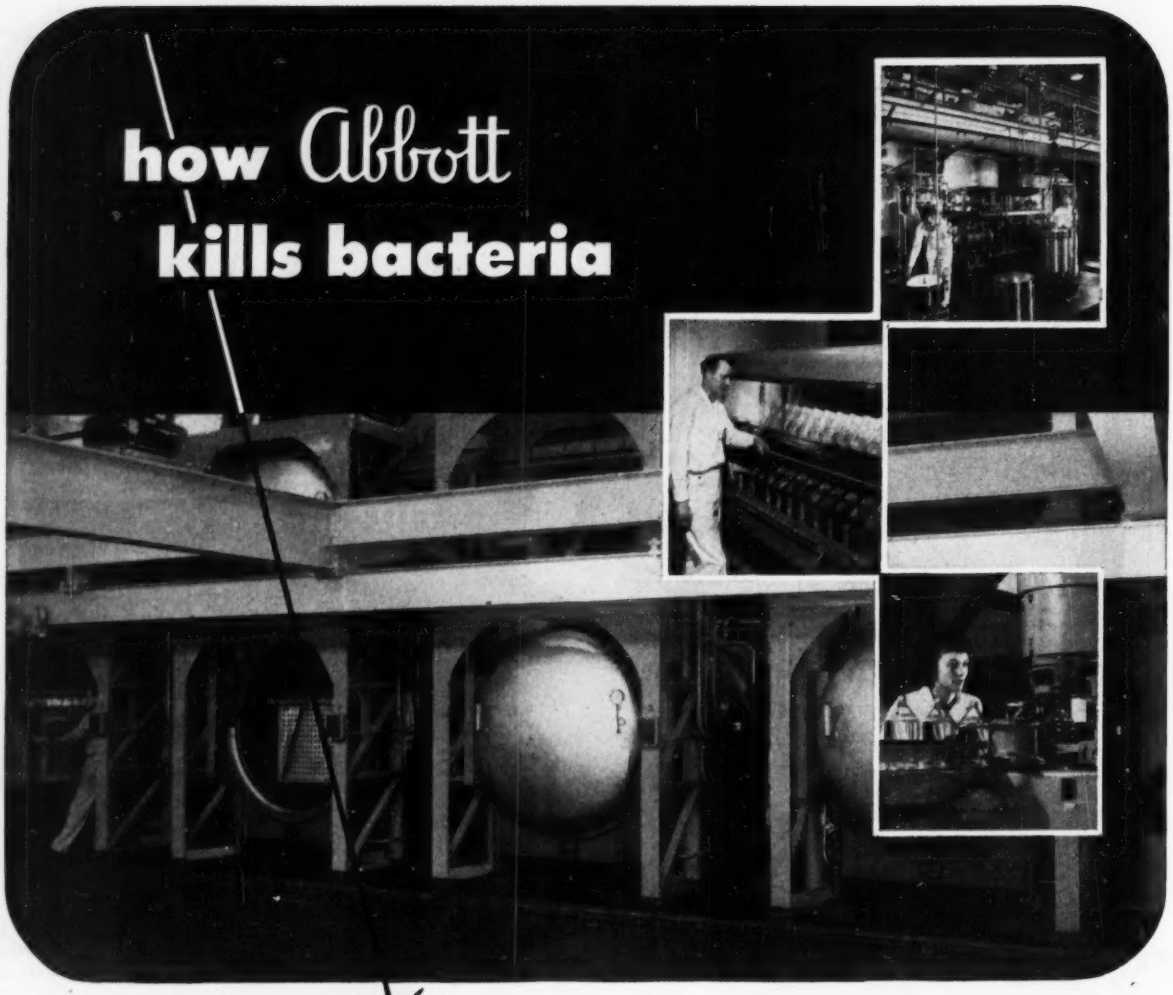
Branch offices

Chicago—San Francisco—Los Angeles—Seattle—Birmingham

Fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS — COMPRESSORS AND VACUUM PUMPS — FEEDERS, AND ASSOCIATED EQUIPMENT

P-149
2112



in GRAVER-built stainless sterilizers

Graver recently fabricated four solid stainless steel autoclaves for use by Abbott in a steam sterilization process at their North Chicago Laboratories. Thousands of bottles of precious intravenous solutions are placed in these cylinders at one time and subjected to bacteria-killing heat. This operation represents an important step in Abbott's scientifically controlled sterilization process...designed to protect the consumer at all stages of manufacture.

The sterilizers, 22′ long, were designed in accordance with ASME Codes to withstand a working pressure of 50 psi. Graver built them for the Adamson United Company, original contractors for the project and suppliers of the patented doors with which the sterilizers are equipped. These sterilizers are an example of the painstaking care in precision fabrication that has contributed much to Graver's reputation.

GRAVER
Alloy
Process Vessels

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

NEW YORK • CHICAGO • PHILADELPHIA • ATLANTA • DETROIT
CLEVELAND • PITTSBURGH • HOUSTON • CATASAUQUA, PA.
SAND SPRINGS, OKLA. • ODESSA, TEXAS • CASPER, WYO.
LOS ANGELES • EDGE MOOR, DEL. • TULSA
SAN FRANCISCO, FONTANA

You a target?

Let's face it . . . we're all targets!

If your plant is not ready with a disaster plan, better act now. There's not a single American plant that's out of range of an intercontinental bomber—and fires, floods, tornadoes or explosions can kill you just as dead as an atom bomb.

It costs next to nothing to take a few simple steps which may save hundreds of lives. Here they are. Check them off today.

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here, again, your CD Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

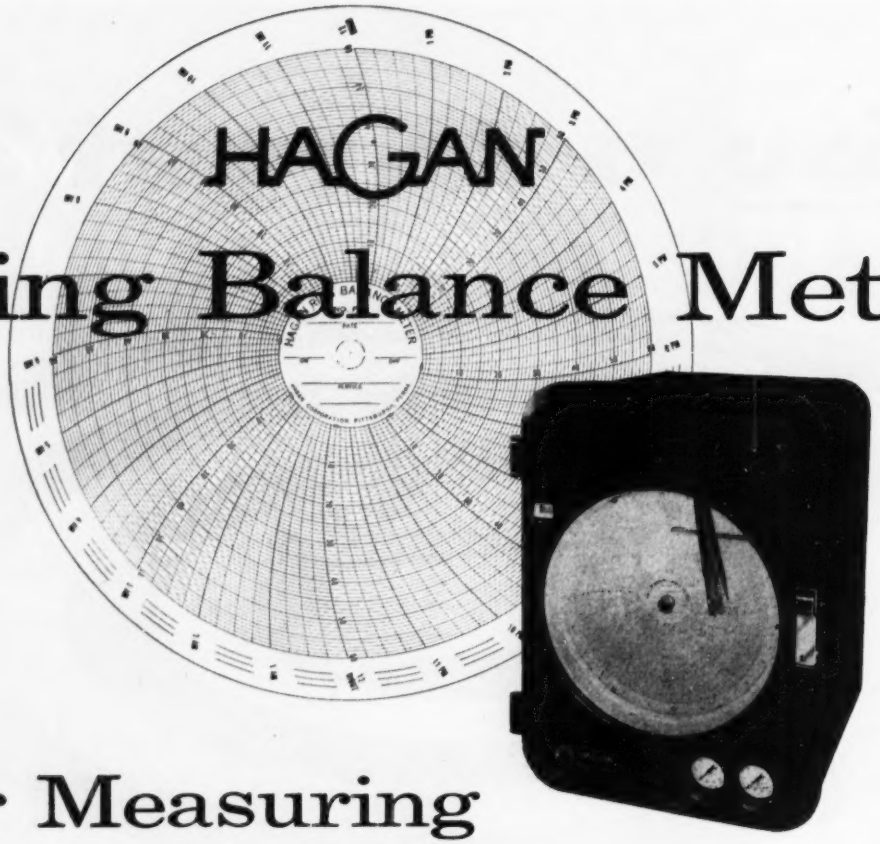
☐ **Encourage personnel** to attend Red Cross First-Aid Training Courses. They may save your life.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . lives are at stake . . . have you a right to delay?

HAGAN

Ring Balance Meters



for Measuring Low Full Scale Differentials

The necessity for measuring flows, with only a low full scale differential available, may result from any of several factors. Type and location of the source of differential, or lines oversize for the flow rate, are encountered most frequently.

The Hagan Ring Balance Meter is particularly adapted for accurate operation at full scale differentials as low as 1″ WC, with any type of primary element—venturi tube, weir, flume, orifice plate or flow nozzle.

For such services, the Hagan Ring Balance Meter has these advantages:

- There is a complete series of interchangeable sensing elements for full scale differentials from 1″ to 420″ WC at static pressures up to 3000 psig.
- Ring assemblies are always selected to have ample power at all flow rates.
- The differential measuring range of any ring is adjustable over 7 to 1 range.
- Dead weight check of calibration takes only a few minutes. It is not necessary to disconnect the meter from the line.
- Automatic compensation for such factors as fluid density, pressure and temperature is a standard attachment.
- Pneumatic or electric transmission is available for remote recording or for automatic control.

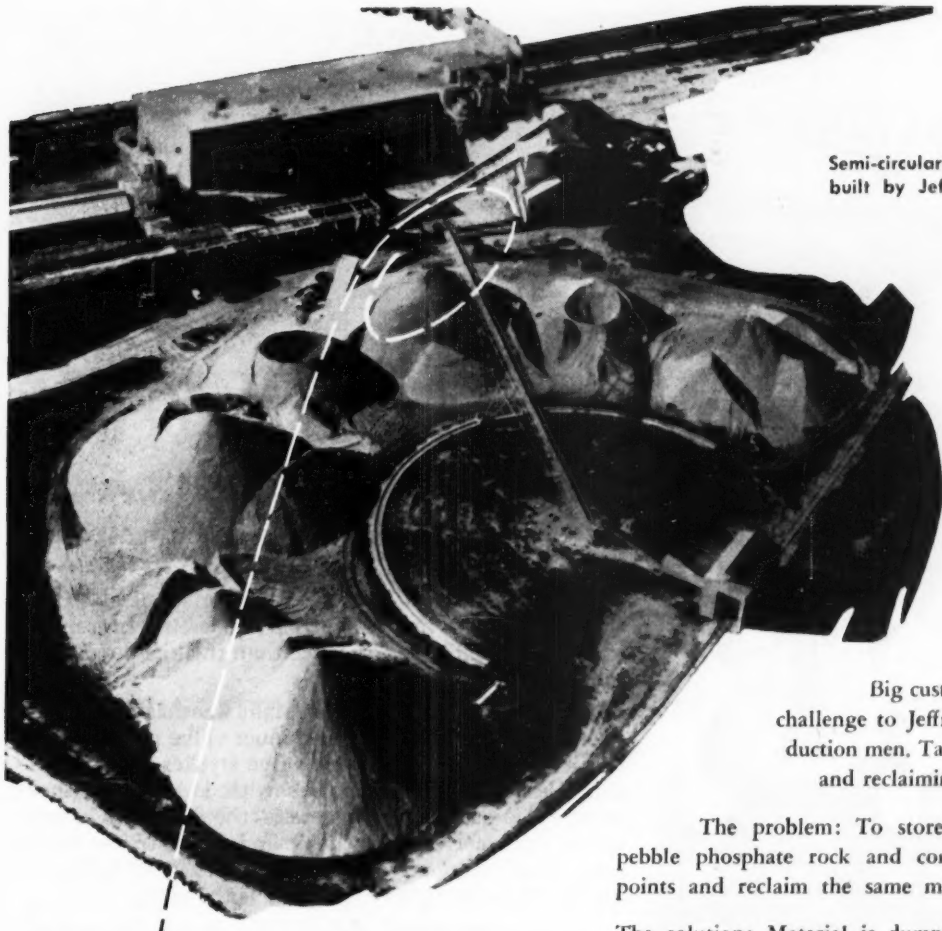
Hagan engineers are prepared to suggest the instruments best suited for new construction or modernization and extension of existing facilities.

HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PENNSYLVANIA

Boiler Combustion Control Systems, Ring Balance Flow and Pressure Instruments, Metallurgical Furnace Control Systems, Control Systems for Automotive and Aeronautical Testing Facilities



Semi-circular storage piles built by Jeffrey Stacker.

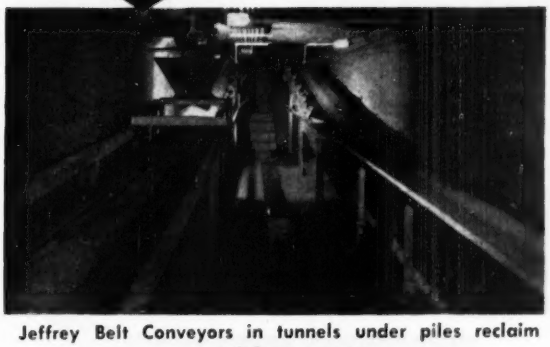
from top to bottom ... it's JEFFREY

Big custom jobs are a constant challenge to Jeffrey engineers and production men. Take this modern storage and reclaiming system for instance:

The problem: To store 1" dia. and smaller pebble phosphate rock and concentrates at different points and reclaim the same material for processing.

The solution: Material is dumped from railroad cars into track hoppers over two Jeffrey-Traylor feeders . . . moves on Jeffrey Belt Conveyor — at 800 T.P.H. — to track-mounted Jeffrey Stacker which turns on a 270° radius to build 80-foot-high semi-circular piles of approximately 320,000-ton capacity. A series of valves beneath the piles discharge onto a traveling hopper which feeds two Reclaiming Belts at 336 T.P.H. each for processing. Rock can be removed at controlled rate from any point in pile or several points at once.

The entire installation is built to withstand hurricane winds . . . to operate efficiently at low cost . . . to meet the rigid engineering standards of Jeffrey and its client. Write for Catalog 852.



Jeffrey Belt Conveyors in tunnels under piles reclaim materials to process.

THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

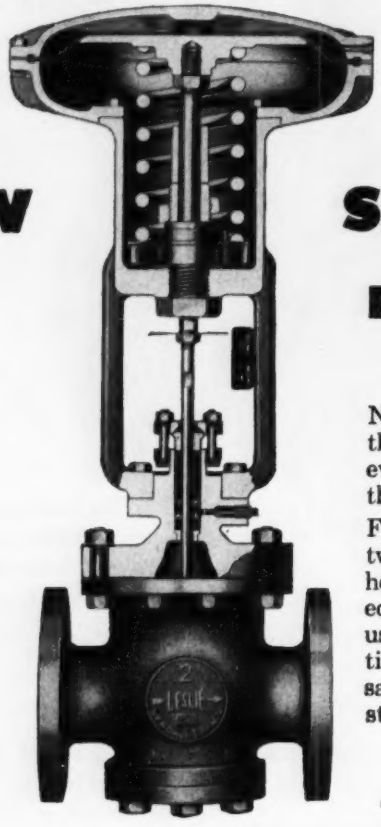
sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED

. . .IT'S A JOB FOR JEFFREY!

something **SPECIAL** in a **STANDARD** control valve...

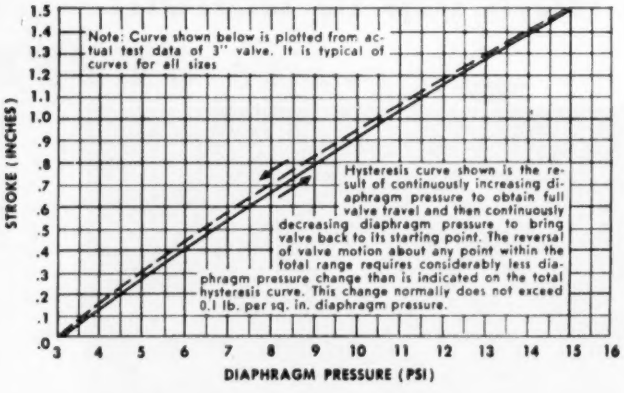


NEW SUPERSTRUCTURE

FOR LESLIE DIAPHRAGM CONTROL VALVES

Now standard for *all* Leslie Diaphragm Control Valves, this new rugged, precision stroke, superstructure means even more reliable performance than the high level set in the past by Leslie.

For instance, linearity (the straight line relationship between diaphragm pressure and inner valve movement) is held to plus or minus 2% for valve strokes up to 1½"—equivalent to .020" for valves with 1" stroke without using valve positioner. Hysteresis, the difference in position of the inner valve on the up and down strokes for the same diaphragm pressure, is held to 2% of full valve stroke for travel up to 1½". Here is the curve.


Note: Curve shown below is plotted from actual test data of 3" valve. It is typical of curves for all sizes
Hysteresis curve shown is the result of continuously increasing diaphragm pressure to obtain full valve travel and then continuously decreasing diaphragm pressure to bring valve back to its starting point. The reversal of valve motion about any point within the total range requires considerably less diaphragm pressure change than is indicated on the total hysteresis curve. This change normally does not exceed 0.1 lb. per sq. in. diaphragm pressure.
STROKE (INCHES)
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
.0
3 4 5 6 7 8 9 10 11 12 13 14 15 16
DIAPHRAGM PRESSURE (PSI)

Only Leslie gives you all of these "made-to-order" advantages in a standard valve.

- ✔ Full-flow, smoothly contoured body
- ✔ Renewable, interchangeable seat rings
- ✔ Bolted stuffing box
- ✔ Molded rings or Teflon packing
- ✔ Thermo-isolating bonnet
- ✔ Accurate part replacement from name plate data
- ✔ Stem flats for ease of connection

Send for
Bulletin 5304 (Single Seated Diaphragm Control Valves)
Bulletin 5305 (Double Seated Diaphragm Control Valves)

TRADE LESLIE MARK
REGULATORS SINCE 1900
STILL FAR AHEAD IN QUALITY AND PERFORMANCE

LESLIE CO., 279 Grant Avenue, Lyndhurst, New Jersey

...*SPEEDLINE* FITTINGS MAKE THE DIFFERENCE AT INDIANA FERTILIZER PLANT

Cost breakdown on this recently completed stainless steel piping installation reveals 96.8% of the total expenditure was for materials . . . only 3.2% for labor!

Impossible? Not with a SPEEDLINE system!

These are the actual figures reported by H. E. Little, Plant Superintendent at E. Rauh and Sons Fertilizer Company, Indianapolis, where SPEEDLINE fittings were used on a new phosphoric acid line. Aligning connectors and formed fittings with exclusive SPEEDLINE tangential simplified installation . . . cut labor time and costs to a bare minimum.

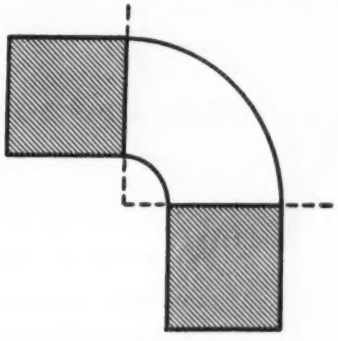
E. Rauh and Sons saved on material costs, too. Plant Engineer was able to use low cost schedule 5 pipe for the entire line—without loss of effective wall for pressure and flow requirements. Intergranular corrosion problems were solved by correct analysis, rather than needless additional pipe wall.

The results? Savings of nearly 50% in material costs as compared to using schedule 40 pipe with conventional screwed fittings—plus greater flow and increased capacity!

Light-wall pipe with SPEEDLINE corrosion-resistant fittings can also cut piping costs at your plant.

Designed especially for economical schedules 5 and 10 pipe SPEEDLINE fittings, speed installation, provide easier aligning and greater flexibility of design to reduce your costs right down the line.

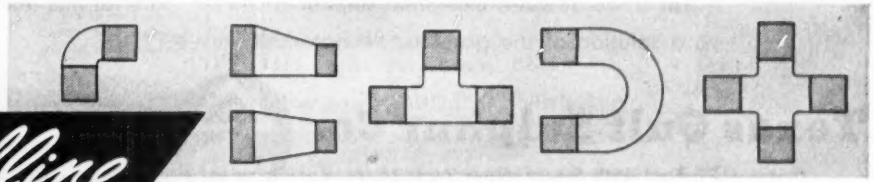
The drawing shows a SPEEDLINE 90° Elbow. The dotted lines show the termination points of conventional fittings. The additional straight section of SPEEDLINE



fittings permits attaching of unions or flanges (as in photo above) without fouling, reduces the number of welds required, and eliminates troublesome curved or angle joints.

Write for a copy of "Speedline Fittings"...without obligation.

***Speedline* distributors are located in principal cities from coast to coast**



Speedline

Corrosion-Resistant FITTINGS—the newest thing in pipeline economy

Manufactured by **HORACE T. POTTS CO.** · 500 E. Erie Avenue · Philadelphia 34, Penna.

. . . there are several starting points for its many uses and users

"What shall we use?" This question always confronts management when it is considering raw materials to be used in operating processes, and is not always easy to decide.

In the manufacture of sulphuric acid, the use of sulphur in some form is mandatory, whether it be elemental sulphur or sulphur in combination with other elements. No single factor can determine which raw material should be used. Relative supply situation, cost of transportation, cost of plant and cost of use are all considered by management.

For three decades elemental sulphur as a raw material has had first choice as a solution of the problem, "What shall we use?"

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Sulphur Producing Units

- **NEWGULF, TEXAS**
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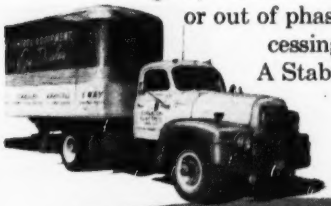
CHEMICAL PROGRESS WEEK-MAY 1954

Stabiline
Type EM4115

Maintain Constant Voltage with STABILINE Automatic·Voltage Regulators

All too frequently varying voltage is not suspected as the cause of process control trouble. It may have come and gone without leaving "fingerprints" — but it can throw electronic gear, solenoids and timers out of balance or out of phase and leave serious processing and recording trouble. A Stabiline Automatic Voltage Regulator can rid you of these worries. It will assure you of a constant voltage despite line variations and voltage drops due to plant loads. Its cost is a trifle compared to the overall control gear and the material in process that it protects.

Specify a Stabiline Automatic Voltage Regulator for your next control panel and add it to your present panels.



Be sure to see Superior Electric's Mobile Display when it is in your area.

THE SUPERIOR ELECTRIC COMPANY

1405 Clarke Ave., Bristol, Conn.

Manufacturers of: Powerstat Variable Transformers • Stabiline Automatic Voltage Regulators • Voltbox A-C Power Supplies • Powerstat Light Dimming Equipment • Varicell D-C Power Supplies • Superior 5-Way Binding Posts

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Please send STABILINE Bulletin S351

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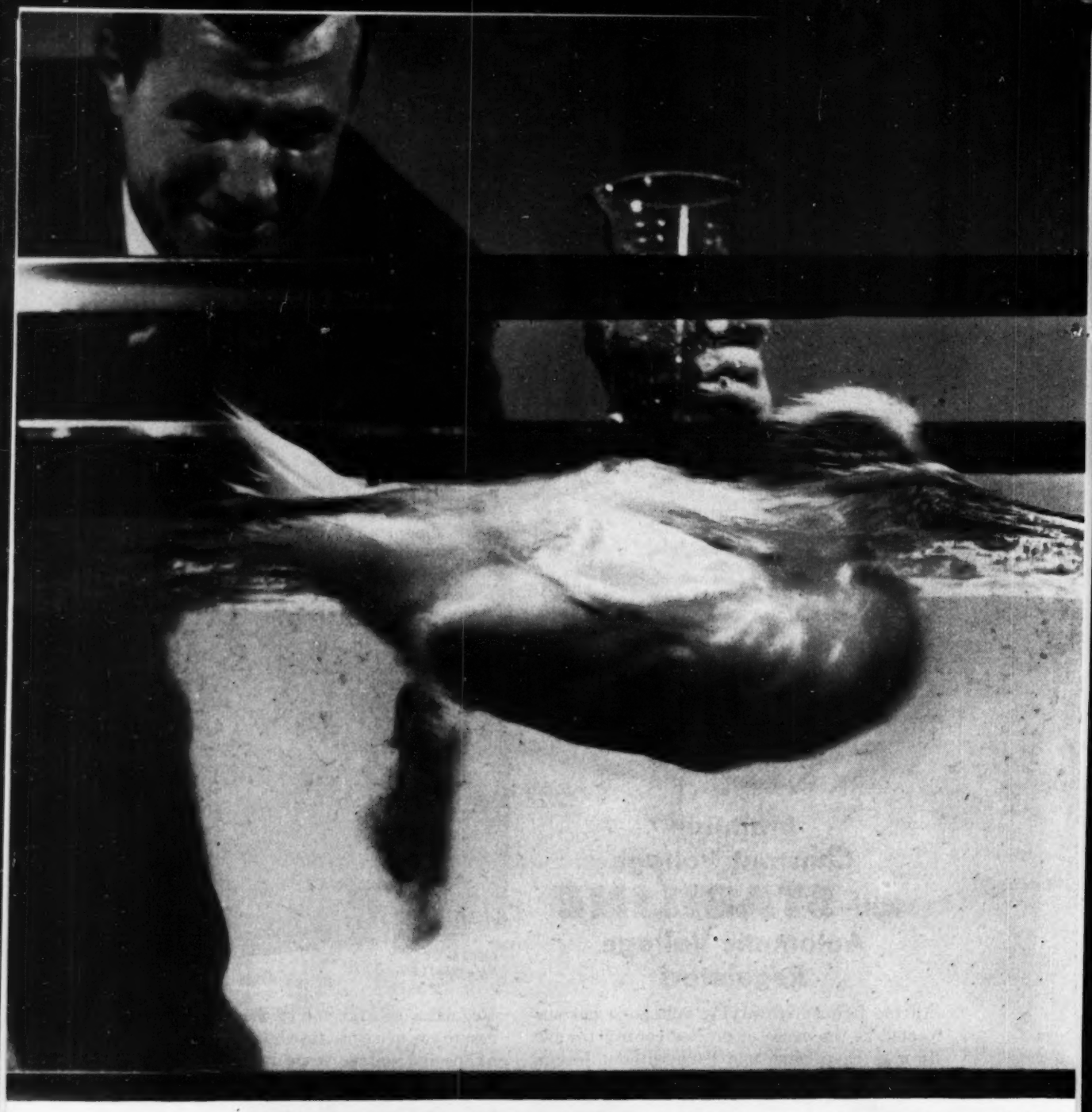
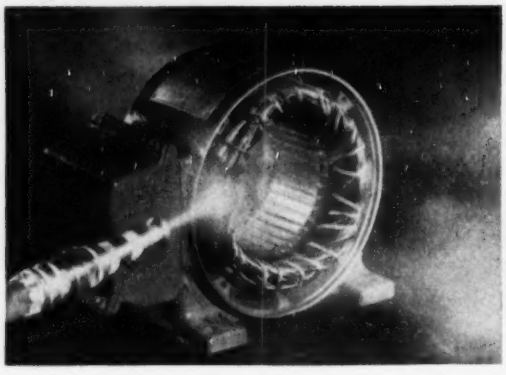




Here's a Life-Line "A" stator that has been given multiple dips and bakes of Bondite. There is no evidence of vapor penetration after being exposed to the toughest insulation test—a jet of steam.

Try tearing a piece of Life-Line's slot insulation, Mylar*. Mechanical strength is eight times greater than ordinary slot cells. Dielectric strength is ten times greater than standard design requirements.

*Trade Mark for Du Pont polyester film

There's more to motor insulation than its ability to repel water

These demonstrations show how new Life-Line A insulating materials provide greater protection for wire, slots and complete stator.

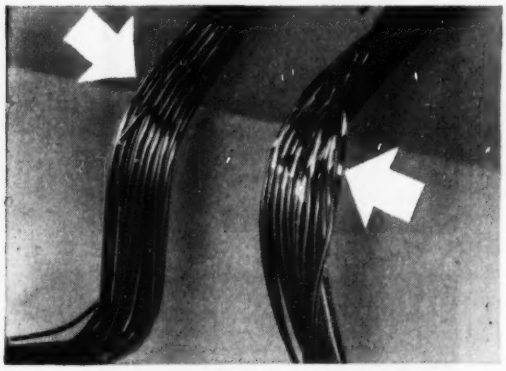
New and improved motor insulations are the word of the day. Actually, there is a considerable range between the run-of-the-mill "improved" insulations and the really outstanding types now available. There is only one way to judge them—by comparison.

For example, many new stator insulations do a more effective job of shedding water. But Life-Line's® new Bondite goes a step further... it repels vapors that penetrate ordinary water-shedding insulations.

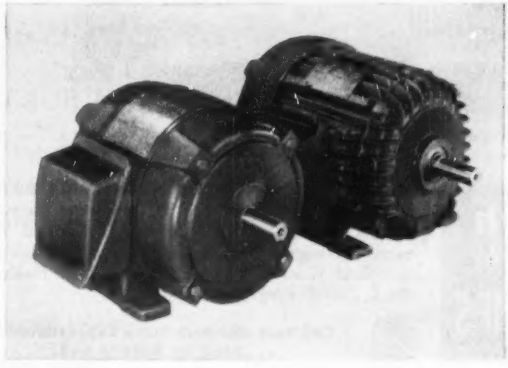
The secret is in the silicone additive that is impregnated throughout Bondite instead of being just applied as a thin outer layer. The complete story of Life-Line's Bondite, Bondar and other new motor improvements is contained in the new Life-Line Booklet B-6154. For your copy, write: Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa. J-21847

YOU CAN BE SURE...IF IT'S Westinghouse

A duck's ability to shed water is only feather deep. A simple wetting agent dissolves the duck's protective coating and he sinks. Many water-shedding motor insulations react much the same; expose them to a simple solvent and they deteriorate.



These two coils have been baked for 50 hours at 400° F. Bent around a finger, the ordinary insulation on the right coil flaked off. Life-Line's Bondar insulation on the left remained intact.



Dependable performance takes balanced design. That's why *every* component in the new Life-Line "A" has been redesigned and integrated with the whole. The result is a motor with superior performance.

"DAVENPORT" CONTINUOUS PRESSES

These continuous presses are available in three sizes. "DAVENPORT" presses are the most efficient mechanical method of extracting excess moisture from semi-solids.

If you have a moisture problem, let "DAVENPORT" engineers assist you.

Send for our complete catalog or . . . for quick reference . . . consult your Chemical Engineering Catalog, 1953 or '54.

DAVENPORT MACHINE AND Foundry Company
DAVENPORT IOWA

DAVENPORT

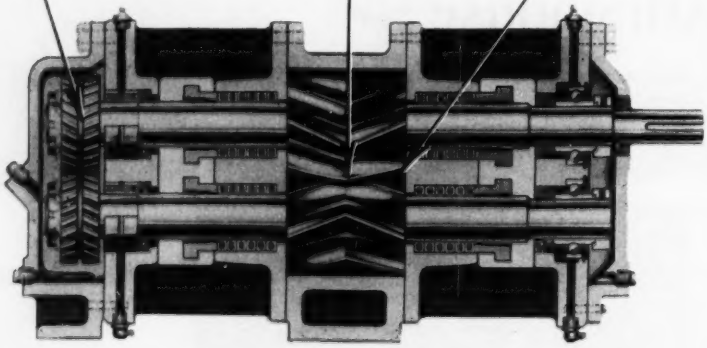
De-Watering Presses and Screens
ROTARY
Steam Tube, Hot Air and Direct Fire Dryers
Water Tube and Air Coolers

GEAR PUMP MAINTAINS EFFICIENCY HANDLING CORROSIVE LIQUIDS

Precision-cut external timing gears maintain proper rotor clearance

No metallic contact between rotors or rotors and casing

Wetted parts made of any machineable corrosion-resistant material



Sier-Bath
External Gear and Bearing
"GEAREX" PUMPS

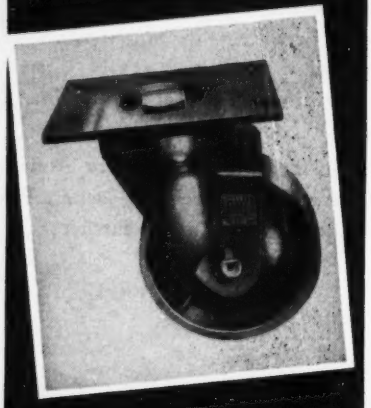
32 SSU to 1,000,000 SSU; 1-550 GPM; 250 PSI for viscous liquids, 50 PSI for water. Direct-connected up to 1800 RPM. Horizontal or vertical construction. Jacketed bodies available. *Sier-Bath Gear & Pump Co., Inc., 9259 Hudson Blvd., North Bergen, N. J.*

Call Your *Sier-Bath* Pump Representative . . . Send for Bulletin G-2.
Founded 1903 Member A.G.M.A.

Sier-Bath Screw, "Gearex" and "Hydrex" Pumps . . . also manufacturers of Precision Gears and Flexible Gear Couplings

DARNELL
CASTERS & WHEELS

For SEVERE SERVICE conditions in Chemical Processing



Darnell Casters and Wheels
Always
SWIVEL
and ROLL

SAVE EQUIPMENT
SAVE FLOORS
SAVE MONEY

Free Manual

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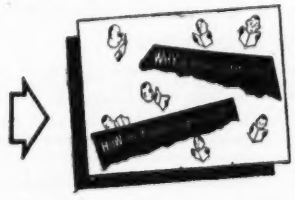

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet." Room 2710.

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You'll Find Metalweld Services A Sound Investment, Not An Expense!

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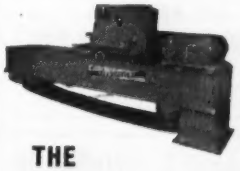

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THE MERRICK FEEDOWEIGHT

MERRICK SCALE MFG. CO.
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Make it a HABIT . . .

to check this page—

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THIS WHERE TO BUY SECTION supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation in the process industries.

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501 Chemsteel Bldg., Walnut St., Pittsburgh 37, Pa.

Send data on engineering & Construction facilities for
ACID-ALKALI-PROOF CONSTRUCTION
of processing & storage tanks & flooring.

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Let them save your time by bringing their broad experience in their specialty to bear on your problems.

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Fabricators Process Equipment

What is your sales potential on the New York market?

A sound analysis will be given you by a $20,000-$30,000 a year sales engineer with an outstanding record of company and product promotion.

If your shop handling capacities are consistent with heavy industry, I can furnish the design experience and innumerable buying contacts to produce business far exceeding your past performances.

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An active, confidential service! Interview at your convenience.

Call, write or wire

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REPLIES (Box No.): Address to office nearest you
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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED: GRADUATE Engineers, preferably chemical, for both Headquarters Consulting and Field Sales Work. For Sales, should have 3 or more years successful record. For Consulting, young men preferred so that our business can be taught and they can advance. Write Box P-1744, Chemical Engineering.

LARGE INDUSTRIAL instrument manufacturer has openings in Boston, Chicago, Philadelphia, Detroit, and New York for Sales Engineers. Engineering graduates between 25 and 30 years of age preferred. Also has opening in Application Engineering Department for experienced Instrument Engineer with chemical engineering background and minimum several years recent experience in application of instruments in chemical or petroleum processing industries. Position requires man with initiative and sales aptitudes. Location: New England. P-1773, Chemical Engineering.

LARGE INDUSTRIAL instrument manufacturer has openings for Service Engineers in New York and Philadelphia. Opportunity for advancement to Sales Engineering after two or three years service. Intensive four months' factory course will be offered. P-2062, Chemical Engineering.

A RECENTLY built, modern operation in Northern New York State is looking for a graduate chemist and who has had at least 3 years experience in the paint or an allied industry for the position of Plant Chemist. Reply giving references and resume of education and experience, and salary expected. P-2146, Chemical Engineering.

SELLING OPPORTUNITY OFFERED

MANUFACTURERS REPRESENTATIVE to sell line of jacketed pipe and fittings. Buffalo, Detroit, North & South Carolina, Kansas, Virginia & Georgia. Write Red Jacket Co., Inc., Investment Bldg., Pgh., Pa.

EMPLOYMENT SERVICES

SALARIED POSITIONS $5,000 to $35,000. We offer the original personal employment service (established 44 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 653 Brisbane Bldg., Buffalo 3, N. Y.

SALARIED PERSONNEL, $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. P, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

INSTRUMENT ENGINEER desires position in Engineering or sales field in Southwest. Six years as field sales-service engineer with leading combustion control and process control manufacturer. B.S. Chemical Engineering. PW-2419, Chemical Engineering.

A GREAT NEW OPPORTUNITY FOR ACTIVE MANUFACTURER'S REPRESENTATIVES!

A long-established nationally known Eastern fabricator of

PROCESS HEAT EXCHANGE EQUIPMENT

is now revamping its entire agency set-up, opening up unlimited opportunities for substantial earnings in the sale of its products to chemical process industries, industrial plants and public utilities, in the following key markets:

Alabama	Louisiana	Tennessee
Arkansas	Mississippi	Washington
Florida	Missouri	Charlestown, W. Va.
Georgia	New York (Western)	Dallas, Texas
Indiana	North Dakota	Detroit, Mich.
Kansas	Ohio	Pittsburgh, Pa.
Kentucky	Oklahoma	

If interested, please give full details in your first letter on specific territory wanted, type and manufacturer of allied equipment now being handled, and size of your organization. Replies held in strictest confidence.

RW-2173, Chemical Engineering
330 W. 42nd St., New York 36, N. Y.

POSITIONS WANTED

EXECUTIVE ENGINEER, 46. Registered chemical, mechanical, civil, electrical. Experienced chief engineer, technical director pulp paper. Education quiv. advanced degree. Resigned, seeking unusual opportunity. PW-2422, Chemical Engineering.

MECHANICAL ENGINEER, twelve years experience in drafting and design, plant layout, remodeling or planning new facilities, estimating, purchasing new equipment and associated duties. Plant Engineer, six years, in charge of mechanical operations, shops, maintenance and construction. Assistant Plant Manager, eight years, manufacturing and processing wet and dry heavy chemicals and food products. Packaging and conveying to storage or docks for shipment in bulk or packages, by rail, truck and boats. PW-2364, Chemical Engineering.

CHEMICAL ENGINEER, B.S. '48—1½ years pilot plant work on synthetic fuels. 4 years experience developing domestic gas burning equipment. Desire position with opportunity in research, development or design. Midwest preferred. PW-2338, Chemical Engineering.

CHEMICAL ENGINEER with twelve years' experience in process instrumentation and operation. Age 34. PW-2211, Chemical Engineering.

CERAMIC AND Mechanical Engineer desires responsible position with progressive firm, either in development or production. 38 years of age, married. 16 years experience in the Portland Cement and Non-Metallic mineral industries, as engineering supervisor, superintendent, and assistant manager of operations. Wide experience in fluid energy grinding of Non-Metallic ores. Material handling, combustion, packaging, and grinding and classification. Supervision of Operations, and maintenance also cost control, production scheduling, and labor relations. PW-2191, Chemical Engineering.

Available

WORKS MANAGER

Chemical engineer with post graduate studies. Age 35. 13 years experience with a major pharmaceutical company as technical and administrative executive in all phases of manufacturing, packaging, quality and production control in antibiotics, parenterals, tablets, liquids, creams and ointments. Excellent record in cost and inventory reduction. Experience includes reorganization, initiation of operations, selection and training of personnel, and formation of policy in both domestic and export fields. Desires change to challenging position with growing and progressive company in the pharmaceutical or related field.

PW-1340, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

SELLING OPPORTUNITIES WANTED

SALES ENGINEERING Organization with wide experience & contacts, wishes to represent manufacturer of Heat Exchangers & Allied Chemical Process Equipment on an exclusive basis i nthe Met. New York North, N. J. and S. W. Conn. territory. RA-2151, Chemical Engineering.

MFRS. REP., well established in Chicago area, expanding personnel, and desires additional related account. Finest connections in chemical, pharmaceutical, and food industries. RA-1925, Chemical Engineering.

PERIODICALS

Wanted to buy back volumes of this and other scientific and technical journals. Ashley, 24 E. 21 St., NYC (10).

MANUFACTURERS' REPRESENTATIVES
Serving
CHEMICAL PROCESS INDUSTRIES

Well known sales representatives selling exclusively to the applied chemical industries desire a top grade materials handling, packaging or related line to dry blenders, air separators, grinders, crushers. Mid Atlantic territory.

RA-2208, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

ELECTROLYTIC PROCESS WANTED

Low Voltage Direct Current available for Electrolytic process work. Approx. 1500 KW.

CW-2257, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

PLANT FOR SALE

Metropolitan Area. 65,000 sq. ft. Three story brick building. 2 oil-fired boilers over 700 B.H.P. each 160 lb. rating. Building sprinklered thruout with freight elevators, 185' loading dock, and 6,000 sq. ft. yard.

Unlimited soft water and city sewerage. Brick garage 10,000 sq. ft. sprinklered and heated. Easily accessible to various communities, highways and turnpike. Plant now operating with plentiful local labor.

BO-7883, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

Wanted Advertising—page 476

A MILLION DOLLAR INVENTORY!

PUBLIC AUCTION SALE

New and Surplus

CHEMICAL and PHARMACEUTICAL EQUIPMENT

On Location At RAHWAY New Jersey

DIRECTIONS: Follow U. S. Highway #1 (New Jersey 25) to Grand Ave., Rahway. Turn East two blocks to sale area.

SALE STARTS ON MAY 13, 1954 10:30 A.M. E.D.T.

Partial Listing Below — **Descriptive Folder On Request**

2 Karbate 100 sq. ft. Condensers—NEW
18 Stainless Steel Condensers, 10 to 250 sq. ft.—some new
3 Copper Condensers, 400 sq. ft.
2 Ross lead-lined Condensers, 26 and 232 sq. ft.
2 100 gallon Stainless Steel jacketed agitated Kettles
15 Pfaudler 60 and 150 gallon glass-lined jacketed evaporating Pans
4 Pfaudler 500 and 750 gallon closed jacketed agitated glass-lined Reactors
5 Pfaudler 500 to 1000 gallon O.T. jacketed glass-lined Kettles
1 Pfaudler 30 gallon glass lined jacketed agitated Reactor—NEW
3 50 to 150 gallon Stainless Steel Stills, (jacketed)
1 Niagara 100 sq. ft. Stainless Steel Filter—NEW
2 Sparkler Hastelloy and Stainless Filters
5 Devine & Stokes vacuum shelf Dryers, 3 to 11 Stainless Steel Shelves—NEW
2 Shriver 30" and 24" plate and frame C.I. closed delivery Filter Presses—NEW
3 Shriver 24" solid rubber 4 eye closed delivery Filter Presses
2 Shriver 18" all bronze plate and frame Filter Presses
4 Mikro No. 2SP Pulverizers, motor driven
1 Raymond No. 40 Stainless Steel Imp Mill
4 Fletcher 40" and 48" rubber covered Center slung perforated basket Centrifugals
2 AT&M and Tolhurst 30" and 36" rubber covered centerslung perforated basket Centrifugals
1 Tolhurst 30" steel centerslung perforated basket Centrifugal—NEW
1 Fletcher 48" bronze centerslung perforated basket Centrifugal
2 500 gal. type 316 stainless steel vacuum receivers
1 600 gal. type 304 stainless steel vacuum receiver
1 300 gal. lead lined agitated tank
1 300 gal. type 316 stainless steel jacketed still
1 Pfaudler 62 sq. ft. glass lined condenser
2 7500 gal. stainless steel horizontal storage tanks.
10 Stainless steel 6" to 16" columns
1 Stainless steel 18" dia. x 29' high column
2 Digesters, steel, jacketed, agitated, horizontal, 8' x 16' and 5' x 10' ASME code
1 Steel Pressure tank 8' x 20' long
3 Rubber lined storage tanks 1000 gal.
1 Lead lined storage tank 8' x 7', 2900 gal.
3 Link-Belt and Creasy Ice Breakers
5 Jet Condensers 2 and 3 stage
30 Agitator drives—Lightnin and Nettco ¼ to 30 HP, most new
10 Compressors — York Ammonia and Freon ¼ to 60 ton
1 Stokes #43A Oscillating Granulator—all stainless
2 Abbe Bluteregess Sifters #3
70 Pumps—Worthite, Duriron, Shriver, Lapp, Stokes, Kinney, Nash, Beach-Russ, stainless, rubber, bronze and cast iron
15 Blowers — Sturtevant, Clarage and Buffalo, motor driven, 50 to 7000 cfm
1 Lydon 8 compartment dryer, 20' wide x 51" long x 61" high
7 Dryers—P & S and Cinco—electric and steam—laboratory to production size
3 Ampoule fillers
150 Motors ¼ to 50 HP—explosion proof and TEFC—3/60/220/440 volt

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Scales; Lectrodrier; Incubators; Portable and Stationary Elevators; Gasometers; Generators; Chain Hoists; Evaporators; Hoppers; Steam Traps; Crucibles; Shakers; Gear Reducers; Separators; Acid Washers; Turbines; Dust Collectors; Lift Trucks; Vibrating Feeders; Electric Furnaces and many more items too numerous to mention

Terms of Sale: Certified Check or Cash
No Confirmation — Immediate Delivery

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Genesee Building Washington 2956 — **Buffalo, New York**

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DEFINITE PRICE SAVINGS

Just Purchased

3—#12 Sweetland Filters, 48 Bronze Leaves, monel covered, on 3" C.C. Hydraulic Hoists, M. D. Sluicing device. 642 Sq. Ft. filtering area.

- 2—UNUSED
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1—Read-Standard Horiz Double Ribbon Mixer, 2000 480 gal., center disch. Practically new.

SAVE TIME— MONEY

1—Troy 6" x 14" High Speed, 3 Roll Mill, Roller bearings, M.D., late type.
1—42" x 120" Buflovac double drum Dryers; other smaller sizes.
1—Sharples C-20 Super D-Hydrator.
1—6" x 15' Sturtevant all steel Jaw Crusher.
1—Stainless Steel Link Belt Roto Louvre Rotary Dryer, #502-16, with motor reducer drive, Ross gas or oil furnace, exhausters, etc. Also #207-10.
1—Oliver 6' x 6' Rotary Filter, acid proof.
1—Baker Perkins size 15 JUE, dbl. sigma blades, 100 gal. Mixer.
1—Day #30 Imperial dbl. sigma blade, jack. Mixer, 75 gal.
1—Swenson Walker Crystallizer 70', jacketed, 20' sections.
1—Shriver 42" x 42" Iron Filter Press, plate and frame, 18 chambers, 1" cake.
12—Sperry 18" x 18" Iron Filter Presses, 12 chambers.
4—Mikro Pulverizers, 4TH, 2S1, Bantam SH.
7—Pebble Mills, 800 gal., 6' x 8'; 235 gal., 5 x 4'; 125 gal; 50 gal; 25 gal.
1—6'6" x 12' Rotary Granulator or Dryer.
3—3' x 50' Rotary D. H. Dryers or Coolers.
3—Mojonnier S/S Vac. Pans, 3', 4', 6'.
3—Anco 4' x 9' Chilling Rolls.
3—B & J Rotary Cutters, #2, #1.

SAVE HERE! POLYVINYL ACETATE UNIT

Approx. 1000 lb. per hr. capacity of dry resin produced from a 50/50 water and granulated resin solution. Filtrate: Acetic. Acid Solution. The solids leave centrifugal with 10% moisture content. Dryer Discharge—1%.

1—500 gal. s/s jacketed agitated Reaction Kettle with Reflux Condenser, 15 HP Explosion Proof Motor, Reeves variable speed transmission and Phila. gear reducer.
1—Solid bowl all stainless steel Centrifugal 30" x 40", motor driven.
2—500 gal. s/s Tanks.
1—250 gal. s/s Tank.
3—S/s Pumps, with 1½ HP Explosion Proof motors.

Above equipment is NEW—was installed but contract cancelled two weeks before completion.
Prefer sell complete, but will sell separate items.

SAVE DOLLARS! LIQUIDATION MODERN MACHINES

(2 Years Old and Less)

1—PFAUDLER GLASS LINED REACTION KETTLE; jacketed, 200 gal. XP motor driven agitator.
2—1000 gal. MONEL KETTLES, 6' dia. x 5' Jacketed, agitated, cone bottom, each with XP motor.
1—BAKER PERKINS "TER-MEER" CONTINUOUS ALL S/S CENTRIFUGAL, 12" basket, XP motor.
1—ALL MONEL ENZINGER FILTER, jacketed, 24" ID, 8 monel leaves.
1—5' dia. x 9'6" Copper Vacuum Pan, C.I. jacket, also steam coils.
1—500 gal. jack. agit. Steel Kettle, XP motor.
1—Haveg column 24" dia. x 30" high.

Including many Condensers, Haveg pipe, XP motors, Duriron & SS Pumps, etc.

WIRE, PHONE, WRITE,
ARRANGE TO INSPECT

WE WANT YOUR SURPLUS EQUIPMENT "CONSOLIDATED"

WILL BUY YOUR IDLE EQUIPMENT—SINGLE UNITS TO COMPLETE PLANTS
SEND US YOUR LIST TODAY

CONSOLIDATED PRODUCTS CO. INC.

Our 37th Year

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Cable Address: "Equipment" Hoboken, N. J.

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SUNRAY OIL CO. SWEET GASOLINE PLANT

EARLSBORO, OKLA.

Operations discontinued in Fall, 1953.
All equipment in excellent condition, still installed.

STRUCTURAL STEEL BUILDINGS

Galv., Corr. Sides & Peaked Roof

Width	Length	Height
36'	71'	16'2"
30'4"	58'9"	10'
28'8"	30'	10'
20'	26'	9'4"
18'6"	25'	12'4"
16'5"	32'	7'
16'	16'	6'8"
14'9"	20'10"	9'10"

COMPRESSORS

(Gas Engine Driven)

14/11" x 20" Cooper, 300 PSI.
14/12½" x 20" Cooper, 175 PSI.
34" x 20" Worthington, 75 PSI.
14" x 20" Worthington, 75 PSI.
13" x 16" Cooper, 75 PSI.
10/4½" x 10" Chic. Pneumatic.

TULSA HEAT EXCHANGERS

1530 sq. ft. Adm. Tubes 24" x 23', 75 PSI.
310 sq. ft. Steel Tubes 13" x 20', 65 PSI (16 units in series.)
256 sq. ft. Brass U Tubes 13" x 16', 54 PSI. (5 units in series.)
65 sq. ft. Steel Tubes 8" x 18'.
26 sq. ft. Steel Tubes 3" x 20'. (6 units.)
16 sq. ft. Steel Tubes 5" x 20'. (4 units.)

CENTRIFUGAL PUMPS

8" x 6", F.M., Fig. 505, gas engine.
8" x 6", Union, 50 HP.
6" x 5", Worthington & Union. (3).
4" x 4", Worthington 4"L-2A, 20 HP.
3" x 3", Gould, Fig. 3470, steam turbine.
2½" x 2½", Worthington & Westco. (3).
2" x 2", Worthington, monobloc.
1½" x 1¼" Worthington, monobloc.
3" x 2" x 3" to 10" x 6" x 12" single and duplex, steam. (7 units.)

STEEL FRACTIONATING TOWERS

84" x 30', 10 trays 75 PSI, mist extractor.
72" x 28' with reboiler.
72" x 16', 6 trays.
60" x 24', 10 trays.
60" x 22', 5 trays.
48" x 24', 10 trays. (2)
42" x 44', 30 trays, 75 PSI, reboiler, reflux condenser & reflux accumulator.
36" x 42'5", 30 trays, 30 PSI, reboiler.
24" x 45'4", 30 trays, 35 PSI, reboiler, reflux condenser & reflux accumulator.
20" x 44'7", 30 trays, 275 PSI, reboiler and 3 reflux condensers.
8' x 8' Oil Reclaimer, 25 PSI, 48 bbl./hr. @ 100° temp. rise, 3" SS tubes.

PRESSURE TANKS—ALL ASME

25,000 gal. 10' x 40', hor., 30# WP. (4)
16,000 gal. 7' x 54' hor., 150# WP. (2)
13,000 gal. 7' x 45', hor., 60# WP. (5)
8,000 gal. 7'x27' hor., 150# WP.
7,000 gal. 7x24'2" vert., 150# WP.
6,400 gal. 7' x 22', vert., 125# WP. (5)

STORAGE TANKS

1,000 bbl. 26' x 16', bolted. (3)
8,800 gal. 10' x 15', vert.
3,100 gal. 5' x 21', vert.
2,250 gal. 4' x 24', hor.
2,100 gal. 6' x 10', vert. (3)
1,750 gal. 6' x 8'3", vert. (2)
950 gal. 4' x 10', vert. (2)
100 to 750 gal., vert. (13)

MISCELLANEOUS

150 HP H.R.T. Boilers, 150 PSI, ASME. (4).
156 KVA Cooper Gas Driven Generator Set, 3 phase, 480 volts, w/exciter.
Emsco Orifice Meters. (5)
Zeolite Water Softener.
Taylor Recording Flow Meters. (8)
Taylor Fulscope Controllers. (10)
Recorders, pressure & temperature. (6)

FOR INSPECTION OF THIS EQUIPMENT, CONTACT EITHER OUR NEW YORK OFFICE, OR TULSA OFFICE AT THOMPSON BUILDING, TULSA 3, OKLA., PHONE—3-4890

★ ★ ★ ★

Other PROCESSING EQUIPMENT available for immediate shipment:

CENTRIFUGES — Sharples Super D-Canter PY14 S/S. Sharples Noxljector 326B-DH2, S/S. Bird 40" Susp. 347 S/S, perf. basket & curb.

DRYERS — Rotary, Vac. 30"x8', 5'x30', 7'x20'. Conveyor — 2'x28'9", 16'x85', 8'x94' S/S. Steam Tube-Louisville 6'x35'.

KILNS—3'x25', 4'x30', 5'x30', 5'x67', 7'x60', 7'x120', 7'x160', 8'x125', 9'x80'. Roto-Louvres—705-20 S/S, 310-16 steel, 310-16 S/S, 207-8 Monel.

REACTORS—3000 gal. S/S, jktd. & coiled; 980 gal. steel, jktd. & agit.; 300 gal. S/S, jktd. & agit.

STAINLESS STEEL FILTER
5'4" x 6' Oliver, Rotary Filter, Agitator, Vacuum, Filtrate & Wash Pumps. All XP Motors and Controls.

STAINLESS STEEL MIXER
300 gal. Baker Perkins, 18-DIM, double arm, 30 HP Motor or Starter.

● **We are always interested in your surplus. Send your list** ●

Heat and Power Co., Inc.

70 PINE STREET | HANOVER 2-4890 | NEW YORK 5, N. Y.

Machinery & Equipment Merchants

FOR SALE

1—Ch. Van. Autoclave 110 Ga. 2000 psi.
2—Sperry 24" Wash Style Presses, 2" Cake, 40 Ch. Hyd. Closures.
1—Sperry 18" Jack. Filter Press.
1—Sweetland #12 Filter, Brze. Leaves.
1—B.P. 20 Gal. Jack. D.A. Mixer.
1—Mikro 2Th Pulverizer—15 H.P.
1—Bird 48" S.S. Sus. Centrifuge.
1—Buflovak 6' Jack. Vac. Crystallizer.
2—Pfaudler Reactors 100 & 500 Gal.
2—Vertical 6,000 Gal. Closed Stainless Tanks.
3—Roball Screens to 40" x 120".
3—Bubble Cap. Alum. Cols. 27" & 36".
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New Horiz. Spiral Mixers 1,000 to 3,000# Cap. Steel & S.S.

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HIGH SPEED Roller Mills 9"x24" to 18"x40".
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1—Steel Shell & Tube, 100 sq. ft.
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FILTERS

2—International T304 St. St. #3 (24" dia.) and #5 (33" dia.)
1—Sweetland #10, 21 leaves, 3½".
1—Sweetland #12, 72 leaves, 2".
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1—Shriver 36" C.I. P&F., 20 ch. cl. dly.
1—Louisville 8-roll Continuous Filter or Grains Press, 24".

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3—13 gal. Autoclaves, T347 St. St., 700# int. WP., 50# Pkt. WP.
1—St. St. T304 Pressure vessel, 18" dia. x 9'4" long, 600# W.P.
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JUST PURCHASED

1—Pfaudler 100 gal. Glass Lined Jacketed Agitated Reaction Kettle
1—W & P 100 gal. double arm jacketed mixer, sigma blades
1—550 gal Stainless Steel Jacketed Kettle, closed top
3—42" dia. Sieve Plate Columns, steel shell 22' high, 18 plates, T316 stainless steel
1—Read ½ gal. Double arm jacketed mixer, sigma blades, stainless steel
1—Day 10 gal. Double arm jacketed mixer, sigma blades, stainless steel
1—Witteman Double Drum Dryer, 24" dia. x 38" long drum, stainless steel sprayed
2—Mikro Pulverizers, stainless steel, Bantam & #1
2—Blaw-Knox ½ gal. Autoclaves, stainless steel, agitated, 200# pr.
1—6' D x 8' L Pebble Mill, Porcelain Lined.
3—Horiz. Double Ribbon Mixers—2 100 & 50 cu. ft. work. cap.
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1—Buflovak 5' D x 12' L Vacuum Dryer.
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1—T304 600# pr.—86 gal.
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1—3000 gal. Horizontal Stainless Steel Tank, 5'4" dia. x 18'9" long, insulated and agitated.

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1—Baker-Perkins #14—JEM Universal Mixer, Jacketed, Vacuum Cover, 50 gal. work. cap., 50 HP motor.
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140—St. St. Flanged Gate Valves, 1", 1½", 2", 2½" x 3.

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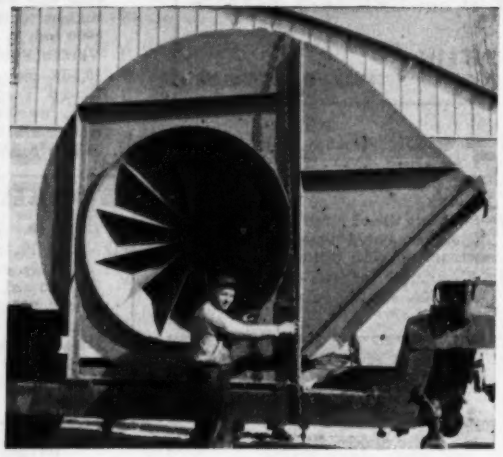

No. 11 Buffalo Exhauster leaves our plant on 3-day delivery for replacement in brick factory.

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ROTARY POSITIVE BLOWERS

Make	Size	Type	Max. Press.	Max. Cap.
Roots—Conn.	20x60	SF	2	6150
Roots—Conn.	22	KAS	3	19
Sutorbilt	3L	Cal.	3	69
Sutorbilt	4L	Cal.	3	132
Roots—Conn.	47	AF	3	124
Sutorbilt	5L	Cal.	3	249
Roots—Conn.	59	AF	3	205
Roots—Conn.	615	AF	3	360
Sutorbilt	14x36	XB	3	3100
Sutorbilt	18x42	XB	4	5320
Roots—Conn.	22x36	RCD	5	5500
Roots—Conn.	67	AF	5	164
Sutorbilt	4M	Cal.	6	76
Sutorbilt	6M	Cal.	6	189
Roots—Conn.	53	AF	7	70

ROTARY-POSITIVE BLOWERS

Roots—Conn.	76	AF	7	200
Sutorbilt	8H	Cal.	10	272
Roots—Conn.	10x10	RCR	10	616
Roots—Conn.	10x7½	RCD	10	440
Roots—Conn.	24x23	RCDH	10	8610
Roots—Conn.	32x32	RCDH	10	14950

TURBO BLOWERS

Make	Size	HP	Volume CFM	Pressure (oz)
Sturtevant	170–225	75	10,100	13
Gen. Blower	1630	75	4,200	16
Spencer	1015	15	2,000	16
Spencer	1215	15	1,675	20

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Ingersoll-Rand	FS-377	85	15,000	20
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Spencer	1230	30	3,350	20
Gen. Blower	2425-1	25	2,500	24
Spencer	Special	200	9,000	48
Spencer	5060-H	75	1,700	80
Allen-Billmeyer	DA-8	15	225	96
Allen-Billmeyer	ED5B-5	30	410	96

60 OTHERS IN STOCK

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American	E	35	Open	23
New York	GI	33	Open	33
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American	ELS	55	Open	36
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Sturtevant	DES 3	70	Open	49
Sturtevant	DES 1	70	SS	56

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1—6' I.D. x 64' steel, 35 trays, design pressure 55#, design temperature 300°F.
1—6' O.D. x 63' steel, 35 trays, design pressure 55#, design temperature 300°F.
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1—6' I.D. x 45' stainless steel, 15 trays, design pressure 850#, design temperature 350°F.
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2—1440 sq.ft. 304 S.S., 75# PSIG, 350°F.
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4—Shriver 30" P&F Filter Presses.
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2—Lee 6'x6' closed, S.S., agitated Tanks 50# pressure.
2—Link Belt 7'5"x20', 3'10"x16' Roto-Louvre Dryers, 316 S.S.
1—Hersey 3'x26' S.S. Rotary Dryer.
1—F. L. Smidth 4'x30' Rotary Kiln.
1—Link Belt Monel 2'7"x8' Roto-Louvre Dryer.
4—Abbe 6'x10' porcelain lined, jacketed, Pebble Mills.
5—Mikro Pulverizers, #2DH, 2TH, 1SH, 1SI Bantam.
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Devine 36" dia. Improv. Unit. closed Jack-Liquor & Impreg. Kettles. Also 100 gal. size.
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1—250 gal. Lead-Lined Kettle.
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New Stainless Steel Tanks 50 to 10,000 gals.
50—Stainless Alum., Copper, Glass & Lead Lined Kettles & Tanks. Also new Stainless.
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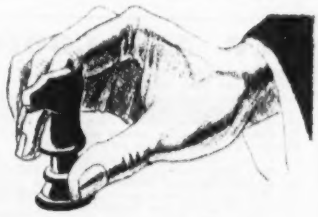

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2—Buflovak Vacuum Drum Dryers, 24" x 20".
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9—Devine Vacuum Shelf Dryers, 5, 9 and 10 shelves.

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1—Mikro #3W Pulverizer.
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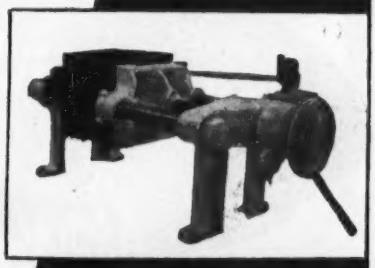

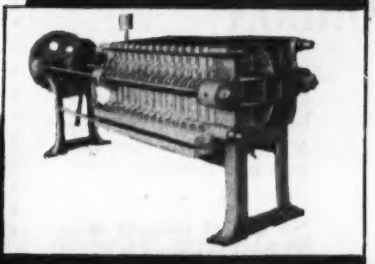

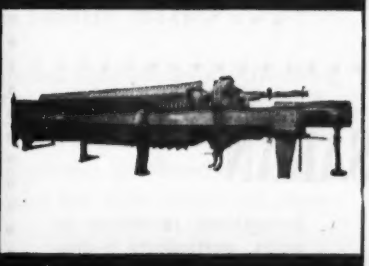

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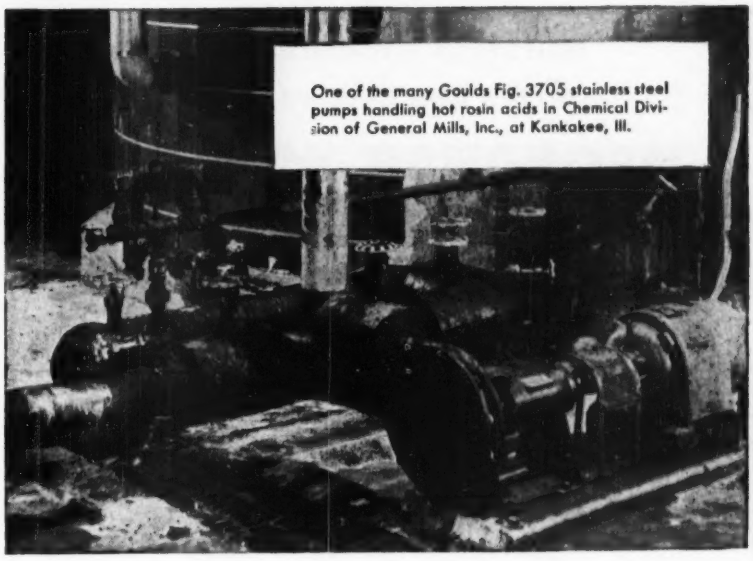

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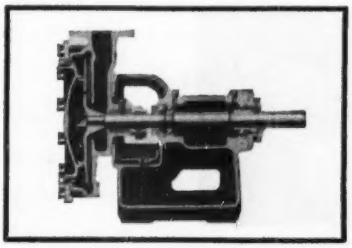

Cross section of Goulds Fig. 3705 chemical pump shows how design limits pressure on stuffing box to suction pressure only. This pump is available in Nos. 304, 316 and FA-20 stainless steel, in all iron, all bronze, bronze fitted, and all iron or all bronze with stainless steel trim. Capacities to 720 GPM. Heads to 200 ft.

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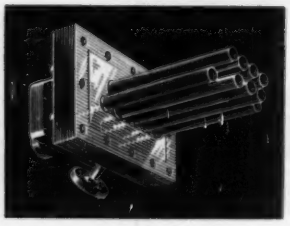

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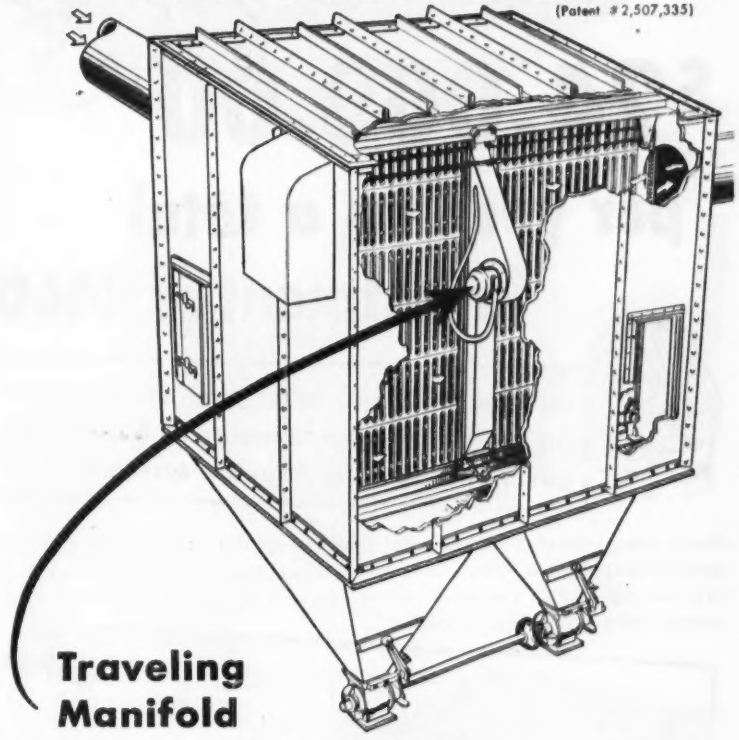
• Continuous automatic operation
• Constant air volume and suction

with NEW PANGBORN 'SELF-CLEANING' COLLECTOR



makes new collector self-cleaning

Now you can get continuous collector operation and constant system performance and efficiency with the new Pangborn "*Self-Cleaning*" Cloth Screen Dust Collector. Uniform air flow and resistance is assured without shutdown of the system for periodic cloth cleaning.

Write today for full details about the new Pangborn "*Self-Cleaning*" Collector that's economical to install, operate and maintain — gives you constant system performance and efficiency. Address: PANGBORN CORPORATION, 2600 Pangborn Boulevard, Hagerstown, Maryland.

Get all these important advantages

- Uniform air flow and suction
- Continuous, automatic operation
- Positive reverse air cloth cleaning
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- Low initial operating and maintenance costs
- Unit construction permitting flexibility of arrangement.

Pangborn DUST CONTROL

STOPS THE DUST HOG from stealing profits

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PneuBin saved $24,000.00 per year on a total investment of $1460!

Savings on time, labor and uninterrupted production flow amounts to $2,000.00 per month for one PneuBin customer.

Here's the proof that PneuBin can save money for its users. By eliminating material stoppages in bins and hoppers, this PneuBin installation is piling up huge savings for its owner. Read this excerpt from a letter* received by the general sales manager at PneuBin:

"... we wish to advise you that we have benefited by the installation of the PneuBin, not only through savings in labor and material, but more important by uninterrupted production, for which we estimate at a total of $2,000.00 monthly savings. In view of the excellent results, we have recommended the PneuBin to our Central Engineering Department for installation wherever similar difficulties are encountered."

*Complete letter on request.

How would you like to have an annual return of 1643% on a $1460 investment?

Take a tip from this company who has solved its flow-stoppage problems with PneuBin. Let a PneuBin engineer show you how your company can effect big savings by decreasing your material flow problems.

PneuBin is designed to alleviate flow stoppage problems in your bins through the principle of "positive displacement." PneuBin moves the Bin contents . . . not the bin. PneuBin neoprene panels, mounted on the inside walls of the bin, operating off the plant air supply, will eliminate rat holing, bridging, caking or high-viscosity hang-up.

SIZES: PneuBin panels are available in 14 standard sizes, 4" to 24" wide, 6" to 72" long. Special sizes can be made if required in quantity.

Send for FREE literature and "Flow Stoppage Report." PneuBin engineers will make recommendations with no obligation on your part.

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Baltimore 3, Maryland

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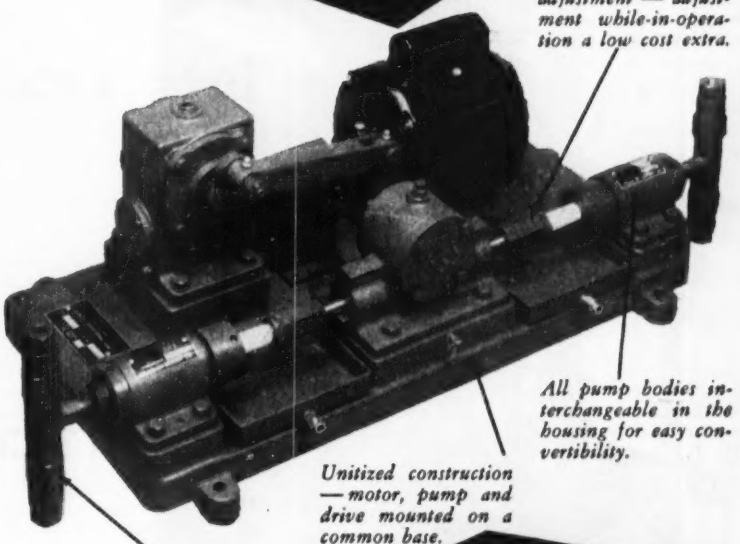
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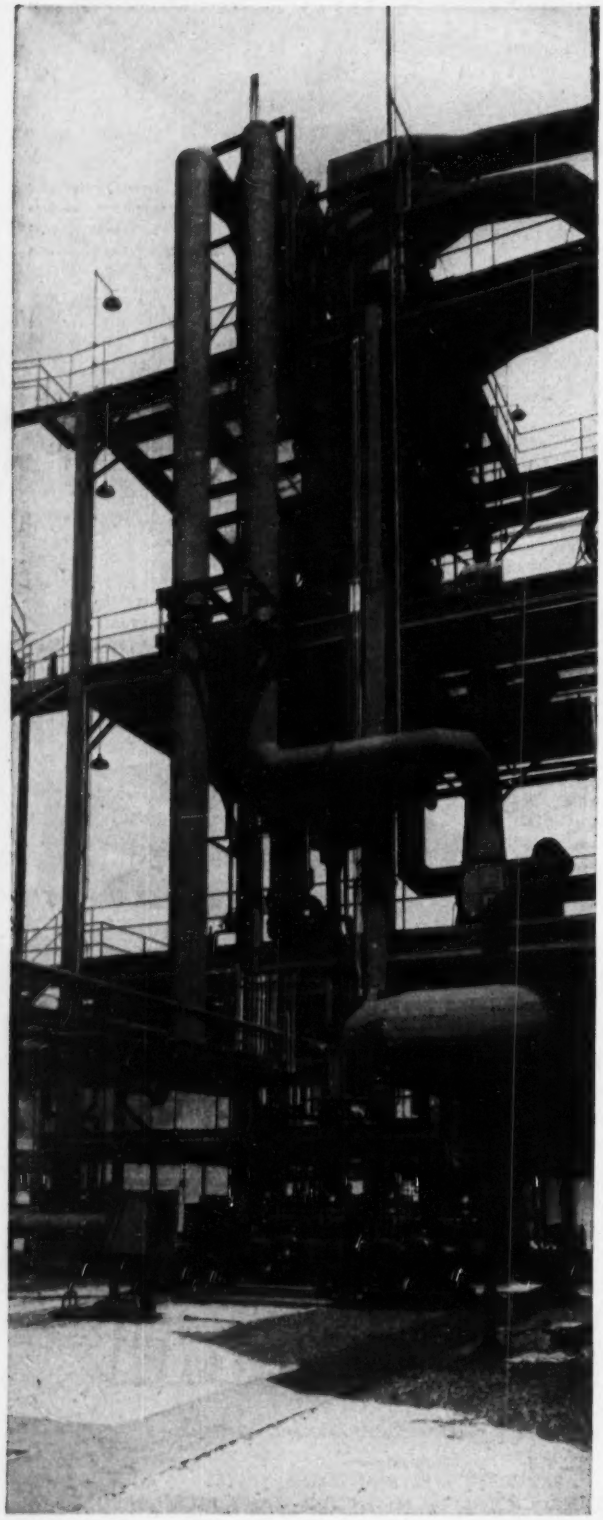

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- **SERVICES**
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For quick replies to your requests for any of the literature mentioned in this section, note the key numbers for the items desired and circle them on the handy, postage free reply cards located adjacent to the back cover.

Chemicals

Acetylene 490A — Can supply pipeline acetylene at purity of 99.5% or better. Features many cost-saving advantages. Data in "The Chemical Century Comes to Calvert City." National Carbide.

Acid, Alkanesulfonic 490B — Valuable information on alkanesulfonic acid . . . an unusually effective catalyst where degradation of sensitive organic reactants must be avoided. Bulletin 11. Indoil Chemical.

Acid, Azelaic 490C — Has unlimited potential use in plasticizers, alkyd resins, polyesters, polyamides & synthetic lubricants. Covers typical characteristics & composition. Emery Industries.

Acid, Fumaric 490D — Covers use of fumaric action in resins for use in molding, casting, laminating & surface coating compounds as well as food & pharmaceutical uses. Bulletin 46. Charles Pfizer.

Acids, Fatty 490E — Features development of a group of unsaturated fatty acids which assure long life and continuing brilliance for white alkyd enamels. Data in Technical Bulletin A-8. Armour Chem. Div.

Acids, Fatty, Coconut 490F — How you can save money by eliminating costly formulation changes made necessary by coconut fatty acids of poor quality. Data in Catalog, "Fatty Acids in Modern Industry." A. Gross.

Acids, Fatty, Coconut 490G — Ideally suited for shampoos and other products that require pleasant, soothing contact with the skin—does not contain irritating low molecular weight fatty acids. Armour Chem. Div.

Acrylamide 490H — Crystalline; stable at room temperature without use of additives; extremely soluble in water; polymerizes easily; etc. Full information in New Product Bulletin 28. American Cyanamid.

Additives, Paint 490I — Improved wetting, dispersing & anti-settling agents . . . effective over broad range of paint formulations. Possess auxiliary film-forming characteristics. Detailed Brochure. Nuodex.

Alcohol, Polyvinyl 490J — Dependable source of supply for use in adhesives, sizes, coatings. Offer many features: non-gelling; free-flowing; fast-dissolving; uniform; etc. PVB 45A. Colton Chemical Co.

Alcohols 490K — 52 p. includes valuable data on 20 alcohols sold in commercial quantities. Covers uses & suggested applications, properties, shipping, etc. Book F-4731. Carbide & Carbon.

Alcohols, Fatty 490L — Vacuum-distilled by techniques that have been improved over period of 25 years. Booklet on "Possibilities" tells uses as intermediates, additives, emulsifiers, etc. M. Michel & Co.

Alumina, Activated 161 — Advantages of activated alumina for hydrogen fluoride alkylation: elimination of silica migration; better fluoride removal; dries alkylate while in process. Reynolds Metals.

Amines, Polyethoxy 490M — Describes reaction products of Primene JM-T with ethylene oxide. Properties suggest uses in fields of surface-active agents & corrosion inhibitors. Bulletin SP-127. Rohm & Haas.

Ammonia, Cylinder 490N — Presents valuable handbook, "Guide to Use of Barrett Brand Cylinder Ammonia." Shows most economical usage; contains chemical properties, handling, charts, etc. Nitrogen Div.

Ammonia Leak Detector Kits 490O — Company makes available upon request a useful ammonia leak detector kit. These handy kits are conveniently pocket size, and can be put to use over and over again. Nitrogen Div.

Benzol 490P — Technical Bulletin 109-53, "Benzol Toluol Xylol," contains numerous photographs of Texas plant & offers specifications on company line of aromatics. Cosden Petroleum Corp.

Benzophenone 490Q — Use in perfumes well known . . . but potential in synthesis may still be exploited. Suggested as intermediate for certain antihistaminics, hypnotics, etc. American-British Chem.

Calcium Acrylate 490R — Describes monomeric, water-soluble salt which will polymerize in presence of catalyst to a water-insoluble & rubber-like gel. Includes applications in Bulletin SP-42. Rohm & Haas.

Carriers, Catalyst 20-1a — Alundum carriers prove highly successful in reactions such as those involved in manufacture of phthalic anhydride, maleic anhydride & oxidation of ethylene. Bulletin 7. Norton.

Catalysts 90 — Manufacturers to specification dozens of catalysts for many different & complex manufacturing processes—hydroforming, alkylation, dehydrogenation, etc. Harshaw Chemical.

Chemicals 490S — 103 p. covers data on uses, product quality, & shipping for alkalis, solvents phosphates, barium products, magnesia products, agricultural products, etc. Illustrated. Westvaco.

Chemicals 490T — 44 p. includes specifications & properties of high-quality chemicals for agricultural & industrial uses. Covers ammonia, ammonium nitrate, methanol, etc. Spencer Chemical Co.

Chemicals, Industrial 490U — Illustrated booklet, "What It Is/What It Does," covers various company divisions: Industrial Chemicals; Organic Chemicals; Fine Chemicals; etc. American Cyanamid Co.

Chemicals, Industrial 490V — Company makes available 16 p. descriptive booklet, "Harshaw Chemicals for Industry & Laboratory," which offers pertinent data on their major activities. Harshaw Chem.

Chemicals, Laboratory 490W — 304 p. Catalog with largest listing (7344) of laboratory chemicals available today. Covers structural formulas, molecular weights, melting & boiling points etc. Fisher Scientific.

Chemicals, Organic 490X — New catalog includes over 2500 fine organic chemicals plus structural formulas, molecular weights, melting points, boiling points, specific gravities, etc. Brothers Chemical.

Chemicals, Organic 490Y — Describes principal physical properties of more than 80 products which comprise the commercial, semi-commercial & laboratory chemicals offered by company. Catalog 54-1. Sharples Chem.

Chemicals, Photographic 490Z — Foremost in photographic chemicals—hypo—carbonate—sulfite—and other photo pure chemicals. Offers Folder describing company product line. A. R. Maas Chem. Co. Div.

Chloral 490AA — Physical properties, specifications, stability & storage, shipping data, toxicity & precautions, reactions with organic compounds, etc. in 26 p. Technical Bulletin 206. Westvaco.

Concentrates, Arwax 490BB — Versatile hot melt combinations of synthetic polymers with paraffin & micro-crystalline waxes finding new uses among paper converters. Data Sheets. American Resinous.

Defoamers L420 — Versatile, efficient defoamers save space now wasted on foam, cut processing time, eliminate waste & fire hazard of overflowing foam, etc. Offers descriptive data. Dow Corning.

Detergents, Synthetic 490CC — Technical data on a heavy duty detergent based on tallow that features outstanding detergency at lowest possible cost. For warm or hot water washing of wool, cotton, etc. Antara.

Dibutyl Phosphite 490DD — Covers description, typical analysis, physical properties, numerous suggested uses, typical reactions, toxicity and availability, in detailed Technical Data Sheet S-38. Westvaco.

Dicarboxylic Anhydride 490EE — Covers chemical and physical properties, reactivity and suggested uses. Also includes a list of 68 literature references. Technical Bulletin 1-5. National Aniline Division.

Dimethyl Sulfate 490FF — Highly reactive compound, a useful methylating agent in organic synthesis. Information on specifications, properties, suggested uses, bibliography, etc. E. I. du Pont de Nemours.

Dioctyl Phthalate 490GG — A colorless high boiling ester of outstanding value as a primary plasticizer for vinyl resins. Describes properties & uses in Technical Service Bulletin E-6. Witco Chemical Co.

Dyes, Direct 490HH — Information on direct dyes for resin aftertreatment. Dyeing and fastness properties of dyes shown in detail by tables and graphs. Technical Bulletin 835. American Cyanamid.

Emulsifiers 490II — Technical Bulletins F-2, "Armour Emulsifiers," & E-4, "Cationic & Non-Ionic Emulsifiers for Insecticides," offer pertinent data for the emulsion technologist. Armour Chem. Div.

Ethylene Oxide 490JJ — Offers consistent high-quality in quantity you need—when you need it. Makes available reference "Operating Procedures for Handling Ethylene Oxide." Carbide & Carbon.

Fumigants, Soil 490KK — Presents an informative leaflet outlining the use of a soil fumigant which provides dependable control over wireworms, nematodes and other soil pests. Eston Chemicals Division.

Fungicides, Fruit 491A — Years of successful results prove superiority. Growers get top notch growth, fruit set, and yield . . . plus full disease control. Complete details. E. I. du Pont de Nemours.

Fungicides, Tomato 491B — Control the major fungus diseases of tomatoes. Provide numerous features: top record of performance; mild on plants; increased yields; etc. Data on use. E. I. du Pont de Nemours.

Gum, Guar 491C — Company offers informative booklet which describes new hydrophilic colloid and presents technical data on its physical and chemical properties. 16 p. Stein, Hall & Co.

Herbicides 491D — Control pigweed, purslane, ragweed, etc. in asparagus & certain cucubits. Data on how to use, when to use, recommended dosages. Illustrated Booklet 16-A. Naugatuck Chem.

Hydrides, Metal 491E — Makes available a 24 p. illustrated Brochure, with pertinent information on the activities, products developed and manufactured, and personnel of the company. Metal Hydrides.

Hydrogel 103a — Manufacturers are using economic hydrogel to induce microporosity in rubber, resins and plastics. Offers complete information in Product Data Sheet. Davison Chem. Corp.

Hydrogen Peroxide 491F — Powerful oxidizing activity can be used to advantage in a large number of organic reactions involving the benzene ring. Covers properties & applications. E. I. du Pont de Nemours.

Hydrogen Peroxide 491G — Discusses stability of hydrogen peroxide in concentrations above 90% by weight, and factors which influence its rate of decomposition. Bulletin 55. Buffalo Electro-Chemical.

12-Hydroxystearin 491H — Presents data on Castorwax 12-hydroxystearin —where and why low-cost Castorwax is used. Includes formulation information. Technical Bulletin #7. Baker Castor Oil Co.

Intermediates 491I — Offers detailed brochure, "Individualized Intermediates," which lists pertinent physical characteristics of a number of intermediate organic compounds. Michigan Chemical Corp.

Intermediates 491J — Illustrated, 30 p. with valuable data on line of organic intermediates. Nomenclature & classification system facilitates location & ordering of listed compounds. Hilton-Davis.

Isobutyraldehyde 491K — Offers publication prepared to stimulate the thinking of industrial research and development personnel concerning isobutyraldehyde & its derivatives. Eastman Chem. Products.

Latex 491L — Broad general principles for application and handling of aqueous colloids, including latex, Lotol, Naugatex compounding pastes, etc. 16 p. Bulletin 100. Naugatuck Chem.

Latex 491M — Announces the development of an improved latex for clay coated paper. Describes improvements along with data on properties handling techniques, etc. Illustrated, 31 p. Dow Chemical.

Latices, Styrene-Butadiene 491N — Uses and characteristics of styrene-butadiene latices, offered in five different copolymer ratios, are described in 11 p. Technical Bulletin C-4-191. Koppers Co., Chem. Div.

Magnesium Aluminum Silicate 491O — Veegum is purified colloidal magnesium aluminum silicate. Non-toxic & non-irritating, it is opaque, white, & non-gelatinous. Data in Veegum Bulletin C122. R. T. Vanderbilt.

Melamine 491P — Up-to-date treatise includes specifications, physical properties, chemistry and structure, applications, toxicity, test methods and an extensive bibliography. American Cyanamid.

Methyl Amyl Acetate 491Q — Includes physical & physiological properties, specifications & shipping data, resin solubilities, performance in nitrocellulose lacquers, etc. in Bulletin F-6264. Carbide & Carbon.

Methylamines 491R — Provides specifications, properties, chemical reactions, and valuable information on the many uses for CSC methylamines, in Technical Data Sheet No. 12. Commercial Solvents.

Molding Compounds, Kralastic 491S — Produce outstanding toughness & rigidity without sacrificing other desirable properties. Sections cover types & applications, fabrication, properties. 20 p. Naugatuck Chem.

Petrochemicals 302a — New petrochemical plant now making high-purity aromatics—nitration benzene, nitration toluene, ten degree xylene. Pertinent information in technical bulletins. Sun Oil Co.

Pharmaceuticals, Bulk 491T — Company makes available new 1954 Price List which includes data on bulk pharmaceuticals, intermediates, amino acids, reagents, enzymes. Winthrop-Stearns Special Chem. Div.

Plasticizers 491U — Offer numerous features: lower cost; less migration; better U. V. light stability; better low temperature flex; etc. Catalog provides full technical information. Ohio-Apex.

Plasticizers 491V — Provides valuable information on plasticizers used by the plastics, coatings and rubber industries, in detailed booklet F-5882, "Flexol Plasticizers." Carbide & Carbon Chem.

Plasticizers, Epoxy Vinyl 491W — Will give vinyl sheeting, coatings, & extruded or molded products superior permanence & durability—even under the most severe conditions. Technical Bulletin. Archer-Daniels-Midland.

Plasticizers, Vinyl 491X — Covers new series of vinyl plasticizers, epoxy fatty acid esters. Text and data presented in tables and photos show plasticizer performance. Bulletin 56. Buffalo Electro-Chemical.

Polyethylene 491Y — Presents information about molding, extruding & other ways to use Bakelite polyethylene as well as properties of resins. Includes photos & tables. Folder GA. Bakelite Co. Div.

Polyethylene 491Z — Coat paper with polyethylene on your present waxing equipment: no capital investment necessary; concentrations to 100% possible; improved quality coatings; etc. Semet-Solvay.

Polymers 491AA — Detailed booklet includes sections on: Polyco Resin Emulsion Polymers for the Textile Industry; Textile Applications of Polyco Emulsion Polymers; etc. American Polymer.

Polyvinyl Acetate Beads 491BB — Finding increased uses in formulation of adhesives, inks, coatings, saturants, etc. Includes data on grades, properties, shipping and storage. PVB 510. Colton Chemical Co.

Resins, Polyester 491CC — Presents information on versatile family of liquid polyester resins, for laminating, impregnating, casting or molding. Includes features & applications. Naugatuck, Chem.

Resins, Polyester 491DD — Latest information about formulations and properties of Bakelite polyester resins and their use in the manufacture of reinforced plastic structures. Booklet L-10. Bakelite Co.

Resins, Polyvinyl Chloride 491EE — Covers series of new polyvinyl chloride resins of unique versatility. Includes physical properties & peformance characteristics in Sales Service Bulletin 6. Firestone Plastics Co.

Resins, Vinyl 415 — Coatings based on Bakelite vinyl resins withstand direct contact with sulphuric acid, sodium hydroxide, exposure to corrosive fumes, salt air, etc. Bakelite Co. Div.

Resins, Vinyl 491FF — Have outstanding inherent light & heat stability & yield products of exceptional dryness, toughness & durability. Properties, uses & processing methods. 20 p. Naugatuck Chem.

Ricinoleates, Metallic 491GG — Metallic ricinoleates as a class exhibit marked solubility in alcohols, ether alcohols & glycols. Offers technical data—solubility information & property sheets. Baker Castor Oil.

Seed Protectants 491HH — For corn, clover, small seed legumes, beets, etc. . . . prevent seed decay and "damping-off." Covers slurry method and dry method of seed treatment. Bulletin 5. Naugatuck Chem.

Sequestering Agents 491II — Superior iron chelating properties overcome trace iron problems, in addition to sequestering calcium & other metal salts to degree never before attained. Refined Products.

Silicones 491JJ — New developments in silicones, plastics compounds, electrical insulating materials, industrial resins and varnishes, etc. Booklet CDG-101. General Electric, Chemical Div.

Soaps, Metallic 491KK — Used in many industries: paint; lacquer & varnish; plastics; rubber; lubricant; etc. Data in informative 32 p. book, "Metallic Soaps for Research & Industry." Metasap Chemical.

Soda, Caustic 491LL — Illustrated 28 p. manual, "Caustic Soda—Unloading & Handling," offers practical information on accepted safe practices in working with this chemical. Columbia-Southern Chem.

Sodium Hexa-m-Phosphate 491MM — Covers description, shipping & screen specifications, solubility, calcium sequestration, water softening requirements, applications, etc. Technical Bulletin C-1001. Westvaco.

Sodium Lauryl Sulfate 491NN — Sodium lauryl sulfate for . . . cosmetic manufacturers . . . textile finishing mills. Meets rigid standards for purity and uniformity. Offers complete technical data. Rohm & Haas.

Sodium Metal 491OO — Data on procedures for handling sodium in solid, liquid or dispersion form. Tells how this highly reactive metal can be safely used in plant operations. E. I. du Pont de Nemours.

Sodium Sulfides 165a — Save time with quick-dissolving sodium sulfides . . . get clear solutions in fifteen minutes. Describes Hooker products and services in Bulletin 100. Hooker Electrochem.

Sodium m-Silicate, Anhydrous 491PP — Anhydrous sodium metasilicate—the economical detergent silicate—features greater chemical value and cost-saving advantages. File Folder contains full technical data. Cowles Chem.

Technical Literature, cont . . .

Sodium Trimethoxy Borohydride 384	Sodium trimethoxy borohydride is most powerful selective reducing agent for certain functional groups where steric hindrance is present. Data in Bulletin 504-C. Metal Hydrides.
Sodium Tripoly-phosphate 35-Sb	Features many uses: soap builder; manufacture of detergents & water softeners; anti-pitch agent in paper making; clay dispersant; etc. Technical Bulletin VI-52. Victor Chem. Wks.
Solvents 492A	Provides valuable information on Carbitol solvent—physical properties, specifications, shipping data, uses—in new Technical Bulletin F-8291. Carbide & Carbon Chemicals.
Sorbitol 492B	92 p. illustrated "Guide to Cosmetic & Pharmaceutical Formulations" with data on the use of sorbitol & Atlas surfactants in the preparation of drugs & cosmetics. Atlas Powder.
Starches 492C	56 p. fully illustrated booklet, "The Story of Starches," includes valuable information concerning properties, production, applications & handling. National Starch Products.
Sulphur Dioxide R416	For processes that require a superior reducing or bleaching agent, preservative, antichlor, pH control, or neutralizer. Specifications & detailed information. Tennessee Corp.
Trichloro-benzene 492D	Fact Sheet covers chemical & physical properties & suggests many uses: dielectric fluid for electrical transformers; powerful soil poison for termite control; etc. Ethyl Corp.
Trischloro-ethyl Phosphite 492E	Technical Data Sheet S-16 covers description, typical analysis, properties, uses (known & potential), typical reactions, handling precaution, toxicity, availability. Westvaco.

Process Equipment

Autoclaves, High Pressure BR406	Furnish numerous advantages: no stuffing box; magnetically operated agitator; positive agitation; adjustable timer to vary agitation cycle; etc. Bulletin 1051. Autoclave Engrs.
Brush Strips 379	Can be coiled or twisted into many shapes. It can be formed to give intermittent or continuous brushing action. Adapts to stationary or power driven applications. Fuller Brush.
Centrifugals 353	Feature no loss of crystal characteristics during centrifugal separation. Covers pertinent information on performance in new, detailed Bulletin 5405. Western States Machine.
Centrifugals, Continuous 336	Feature Vari-Beach drive which allows instantaneous selection of beach speed from 0 to 300 inches per minute. Data on other features in new bulletin. Tolhurst Centrifugals.
Chasers 304	Chasers (mullers, mixers, edgerunners, etc.) are extremely sturdy in design, and improvements over a period of years have resulted in a minimum of maintenance. Vulcan Iron Wks.
Classifiers, Air 492F	For use in continuous separation of coarse & fine air-borne particles. Covers operational details & advantages over conventional types. Illustrated Bulletin AH-449. Hardinge Co.
Converters, Dry Ice M420	Dry ice converters are A.S.M.E. code pressure vessels especially adapted to charging with full 50-lb. cakes of solid CO_2. Feature no operating costs. Dry Ice Converter Corp.
Cyclones 50	For micro-sizing, desliming, desanding, classifying, dewatering, etc. Combine the action of conventional liquid cyclone & centrifuge. Bulletin 800. Oliver United Filters.
Dehydration, Crystal 131	Super-D-Hydrators provide the maximum efficiency and flexibility for the production of high purity dry crystals. Offers full details in Bulletin 1257. Sharples Corp.
Demineral-izers R444	Variety of mono- and multi-column models (flow rates from 10 to 10,000 gph). Equipped with regenerant tanks and necessary gages, flow meter, etc. Detailed Catalog. Penfield Mfg.
Discs, Rupture 492G	Chemically resistant graphite rupture discs provide positive "safety valve action" for closed systems carrying highly corrosive liquids and gases. Falls Industries, Inc.
Dryers 281	Feature modern drives, metal-to-metal seals, complete choice of materials, anti-friction bearings, dependable running gear, functional design, etc. 12 p. Standard Steel Corp.
Dryers 80	Drying air, other gases and organic liquids to precise, low conditions meet needs of industry and science. Covers description of function and operation. Pittsburgh Lectrodryer Corp.
Dryers BR428a	Offers literature which graphically describes product line. Includes information on dryers (single and double shell), rotary kilns, rotary coolers. Bulletin 16-D-11. Hardinge Co.
Dust Collectors 436	Information on hydro-static precipitators for rotary kiln service. Offer high collection efficiency on even small micron particle sizes. Bulletin No. 277. American Air Filter.
Dust Collectors BR399	Vari-vane construction makes Multi-Wash the only wet method dust collector that washes dust, fumes, and odors out of the air many times. Analysis Book. Claude B. Schneible.
Dust Control 492H	Dust control in asbestos product manufacture. How cloth-tube-type dust collectors are used to ventilate dust producing machines. Illustrated Bulletin 412. American Wheelabrator.
Dust Filters 400	Reverse jet cleaning permits the use of more efficient filter media which gives filtering efficiencies up to 99.99+%. Offers new data on dust control in Bulletin 528. Day Co.
Filters 492I	For difficult clarification problems. Applied where solutions carry fine particles in suspension (colloidal matter) or where solids are sticky or gummy in nature. Eimco Corp.
Filters, Automatic 492J	Designed for large air volume and high efficiency. Includes features, specifications, engineering and performance data in illustrated, 12 p. Bulletin 500. Dollinger Corp.
Filters, Catalyst 492K	Replace cyclones & electrostatic precipitators & offer: complete catalyst retention; hi-temp service; low pressure drop; low maintenance cost. Bulletin 80C. Micro Metallic Corp.
Filters, Metal-lurgical 492L	Superior construction & operational features of continuous vacuum drum type & disc type filters for the metallurgical industries, in illustrated Bulletin F2018. Eimco Corp.
Filters, Dewatering 492M	Information on a new & radically designed dewatering filter. Covers complete operating details, applications, advantages, etc., in illustrated Bulletin AH-450. Hardinge.
Filters, Pressure Leaf 203	For flow rates 2 to 5 times greater than cloth covered presses; positive removal of all suspended solids to desired degree of clarity; etc. Catalog NC-1-53. Niagara Filters Div.
Filters, Stainless Steel 492N	For free-flowing, light to heavy-bodied liquids. Data on tubular, pipe line and vertical floor-mounted filters. Includes photos and dimensional drawings. Bulletin 489. Cherry-Burrell.
Generators, Inert Gas 75	Help meet purging or blanketing problems. Complete with the latest fire checks and safety devices. Full details and technical information in Bulletin 1-10. C. M. Kemp Mfg. Co.
Industrial Equipment 492O	Data on special features, types, sizes & capacities of various product lines of industrial equipment. Describes specific applications. Bulletin WP-1099-B61. Worthington.
Jet Apparatus 259	Can be used to measure & mix in continuous operation, cool & concentrate in continuous application, pump & heat in continuous process, etc. Bulletin SK-1. Schutte & Koerting.
Kettles, Electro-Vapor 139	Electro-vapor kettles put heat to work quickly, efficiently and with a minimum of loss. They are simple in operating principle and almost maintenance-free. Bulletin 2324. Blaw-Knox.
Kilns, Rotary 437a	Efficient thermo-processing of products. Used in production of lime, bauxite, cement, sodium silicate, alumina, etc. Design features in illustrated Bulletin 115. Traylor Engrg.
Kilns, Rotary BR428c	Literature furnished which describes company product line. Includes data on continuous rotary kilns, dryers (single & double shell) & coolers. Bulletin 16-D-11. Hardinge Co.
Kilns, Rotary 492P	Offers many years of experience in designing & building kilns, dryers & coolers for diverse industries including synthetic resins, sand & gravel, oil refining, etc. W. P. Heineken.
Mills, Grinding 492Q	Pulva-Sizers feature dustless operation, ultra fine grinding, easy cleaning, durability, compactness, etc. Also contains data on Com-Bin feeders. Illustrated. Pulva Corp.
Mills, Roller 98a	Increase your output of fine grinding . . . with greater uniformity . . . at lower cost. Includes outstanding features in descriptive Catalog. Williams Patent Crusher & Pulveriver Co.
Mills, Vertical 338	Compact high-speed pulverizers offer an economical means of making super-fine materials to meet today's high specifications. Full details in Bulletin 70. Raymond Division.
Mixers 492R	Presents the story of research, engineering, & manufacturing teamwork that helps you get better fluid agitation & better process results. Catalog B-501. Mixing Equipment Co.

Mixers 372a	Mixers meet tremendous variety of fluid mixing needs. Includes data on side entering mixers, top entering mixers, turbine mixers, etc. in Fluid Mixing Catalogs. Eastern Industries.
Mixers, Laboratory 125a	Laboratory mixers: electric motor driven, direct drive, variable speed & geared models. Air motor driven models also available. Details in Bulletin DH-50. Mixing Equipment.
Mixers, Top Entering 125c	Illustrated 32 p. includes advantages, typical installations, mechanical description, construction details, dimensions and selection tables, etc. Catalog B-102. Mixing Equipment Co.
Mixers, Vertical 493A	Photos illustrate various mixers. Includes mixers with variable speed drives & sizes ½ to 25 hp inclusive. Also data on side entry agitators. Bulletin 532. Conn & Co.
Precipitators, Electrical 243	Presents 40 p. descriptive booklet which includes valuable information on recovering dusts, fly ash, mists, fumes and other suspensions from gases. Western Precipitation.
Presses, Continuous TL462a	Describes continuous presses as most efficient method of extracting excess moisture from semi-solids at the lowest possible cost. Available in three sizes. Davenport Machine & Foundry.
Presses, Filter 479	Designed and made to meet industrial filtration problems . . . offering greater performance, flexibility and economy than ever before. Offers detailed Catalog. D. R. Sperry.
Presses, Filter 493B	Industrial filter presses are efficient, low in initial cost, economical to operate. Includes specifications of construction in illustrated Bulletin 17. Brosites Products Corp.
Presses, Filter 404a	Provide numerous features: low first cost & operating cost; long service life . . . high resale value; operate to 1000 psi at high or low temperatures; etc. T. Shriver & Co.
Process Equipment 312a	64 p. describes corrosion-resistant equipment for the process industries. Includes pertinent information on tanks, towers, ducts, valves, heat exchangers, pumps, pipe, etc. Haveg.
Process Equipment 437b	Complete data on equipment for the process industries. Covers primary & secondary gyratory crushers, jaw crushers, apron feeders, ball mills, etc. 8 p. Traylor Engrg.
Processing Equipment, Chemical 493C	Capacities, sizes, hp requirements, design and operating features for grinding mills, disc & drum filters, crushers, slurry agitators, samplers, dryers etc. Denver Equipment.
Processing & Mining Equipment 493D	Equipment for mining, processing & construction industries. Covers underground rock loading equipment, vacuum filters, ball mills, air motors, etc. Illustrated. Elmco Corp.
Reactors, Three-Stage 493E	For softening or clarifying surface waters for process, industrial or municipal applications & for treatment of industrial waste water. Detailed Bulletin. American Water Softener.
Stills, Compression 81	Reliable source of distilled water of laboratory quality at lowest cost. From 85 gph to 2800 gph . . . motor, engine or turbine driven. Illustrated Bulletin. Cleaver-Brooks.
Stills, Water TR399	Details & specifications on steam heated stills up to 250 gal. per hour; electrically heated type up to 10 gal. per hour; gas heated up to 50 gal. per hour. Consolidated Machine.
Tubular Equipment 493F	Covers standard line of exchangers, evaporators, crystallizers & other tubular equipment for process applications. Includes charts, tables, photos, drawings, etc. Colonial Iron Wks.
Wire Cloth 376	Data on advantages of industrial wire cloth. Includes full range of wire cloth available, fabrication facilities & valuable metallurgical information. Cambridge Wire Cloth.
Wire Cloth L428	Makes wire cloth accurately woven from all commercially used metals in sizes ranging from 4 inches (space cloth) to 400 mesh. Details in new Catalog E. Newark Wire Cloth.

Pumps, Blowers, Compressors

Calculators, Vacuum 62b	For rapid slide-rule calculations. Includes a standard ABCD log scale. Helps to determine the proper pump to be installed for a specific process. F. J. Stokes Mach.
Compressors, Centrifugal 65	Offers complete line of centrifugals for gas compression and refrigeration—up to 10,000 hp in a single unit. Details in "Centrifugal Compressors for Industry." Carrier Corp.
Fans 373	Fans are precision engineered, adapted from high speed aircraft propellers. Have adjustable blade pitch & anti-flutter design . . . require less hp. Full information. Koppers.
Pumps 235	Data on corrosion-resisting pumps for heavy-duty chemical service. Available in 12 standard alloys to supply heads to 240 ft. & capacities to 2000 gpm. Catalog 54. Duriron.
Pumps 493G	If you meter or proportion small volume flows . . . there is a "U" type pump to do a superior job. Full information on all sizes & types. Catalog UP-52R. Hills-McCanna.
Pumps BR401	Presents an informative booklet designed to help engineers in choosing the correct pump for each application. Includes tables and charts. Bulletin TS-6C. Viking Pump Co.
Pumps 66	Reduce maintenance cost . . . feature rugged construction & design simplicity. Wearing parts replaced easily, quickly, at low cost. Range from 10 to 2400 hp. Aldrich Pump Co.
Pumps, Chemical 422	Handle vast group of liquids in chemical industries at lowest possible operating cost & maintenance. Rubber lining assures efficient service. Bulletin 982. Buffalo Pumps.
Pumps, Chemical Transfer 291	For continuous or intermittent light duty in transferring process chemicals. Mechanical shaft seals eliminate stuffing box troubles & shaft leakage. Bulletin B-1606. Peerless Pump.
Pumps, Controlled Volume 493H	Provide solution to low capacity flow control problems. Information on three laboratory and pilot plant controlled volume pumps in Technical Papers 58 and 59. Milton Roy Co.
Pumps, Double Suction 331	Rugged double suction pumps assure long life & low maintenance. Offer heavy duty construction, wide material choice, unit responsibility, etc. Data in Bulletin 08B6146. Allis-Chalmers.
Pumps, Gear RL462	Gear pumps maintain efficiency handling corrosive liquids. Includes valuable data on features and advantages in illustrated Bulletin G-2. Sier-Bath Gear & Pump Co.
Pumps, High Vacuum 62a	High volumetric & mechanical efficiency make pumps economical & reliable units in any vacuum system. Catalog 700, "Stokes Microvac Pumps for High Vacuum." F. J. Stokes Mach.
Pumps, Piston-Diaphragm 33	For controlled-volume pumping of fluids. Flow charts, applications, description & specifications of models of various capacities & constructions. Bulletin 300. Lapp Insulator Co.
Pumps, Slurry 391	Slurry pumps handle extremely thick slurries with high specific gravities. Feature long operating life with little or no maintenance. Offers Bulletin 181. Morris Machine Wks.
Pumps, Vacuum 245	Pumps offer many features: free air displacement of 311 cfm at 360 rpm—15 hp motor; designed for easy accessibility of working parts; etc. Bulletin V51B. Kinney Mfg.
Pumps, Vacuum 62c	Valuable suggestions on installation, starting, servicing, trouble-shooting, & helpful "do's" & "don'ts" on vacuum pumps & vacuum pumping systems. Bulletin 755. F. J. Stokes Mach.
Silencers, Intake-Exhaust 493I	Data on 2 new series of silencers for quieting noise produced by air compressors, blowers, vacuum pumps & other machines expelling high velocity air to atmosphere. Burgess-Manning.
Snubbers 365	Present valuable features: efficient mechanical design; explosion-resistant . . . rugged . . . trouble-free; flexibility of installation; etc. Engrg. Data Catalog. Burgess-Manning.
Snubbers, Air Flow 493J	Air flow snubber & pulsation damper offers many advantages-simple, versatile, trouble-free, etc. Covers construction, operation, dimensions. Bulletin 317. King Engrg.

Instruments & Controls

Analyzers 253a	For the process plant. For continuous control of liquid or gas streams. Record ratio of any 2 wavelengths chosen. Thermostatted; enclosed in explosion-proof containers. Perkin-Elmer.
Analyzers, Gas 493K	Liston Becker analyzers & Brown ElectroniK recorders provide continuous, positive infrared analysis and control of plant streams. Data Sheet 10.15-10. Minneapolis-Honeywell.
Analyzers, Multi-Component 253b	For the pilot plant. Continuously record the concentration of up to six components in a pilot process stream on a six-minute cycle. Offers details in Bulletin. Perkin-Elmer.
Comparators M416	For quick, easy determinations of pH, chlorine, phosphate or nitrate. Covers theory & application of pH & chlorine control & describes line of comparators. W. A. Taylor & Co.
Control Packages, Furnace 493L	Provides valuable information on complete control packages, individually designed for specific furnace, oven, kiln or dryer applications, in detailed Bulletin P1260. Bristol.

Essential Data on All New Improvements and Developments.

Technical Literature, cont . . .

Controllers, Pressure 55 — Data on pressure controllers (non-recording) designed to handle both positive & negative pressures, from high vacuum to pressures of up to 10,000 lbs. Black, Sivalls & Bryson.

Controllers, Time Cycle 30-1 — Offer precise, automatic timing of the sequence & duration of processing operations involving temperature, pressure, mechanical motion, electrical energy. Bulletin 98154. Taylor.

Controls, Mill Feed, Electronic L397b — Furnishes complete data on an electronic mill feed control which increases grinding mill capacity 8 to 20%. Details on the "Electric Ear" in Bulletin 42-11. Hardinge Co.

Dynamometer Systems 494A — For testing internal combustion engines, transmissions, torque converters, pumps, fans, compressors, etc. Covers features in Bulletin GEA-5923. General Electric Co.

Dynamometers 494B — Describes rugged, dependable force measuring cage of limitless application. Offers valuable features: overload protected; fatigue tested; etc. Illustrated. W. C. Dillon.

Gages, Tank TL403 — Information on 100% automatic tank gages for gaging liquids of all kinds. Gages are approved by the Underwriters' Laboratories. Offer complete details. Liquidometer Corp.

Indicators, Moisture 494C — Used in air or gas lines to give a positive visual indication of presence or absence of moisture in line. Construction details, dimensions, etc. Bulletin 323. King Engrg.

Measurement, Steam 494D — Engineered equipment package makes possible the measurement of steam under widely different load conditions. Description & advantages in Application Memo K19. Builders-Providence.

Meters 386 — Handle more than 150 liquid chemicals & food ingredients. Sizes from 25 to 1000 gpm. Bronze construction. Offer sustained accuracy & low maintenance. Data Book 566-Q. Neptune Meter.

Potentiometers R403 — Miniature gage pressure potentiometers in standard ranges from 0-100 to 0-5000 psi. Feature extreme ruggedness and accuracy. Data in Technical Bulletin. Bourns Labs.

Power Supplies, DC 494E — Presents data on new, inexpensive regulated DC power supplies which have unusual stability. Includes special features and specifications in illustrated Bulletin B-203. Millivac.

Pyrometer-Controllers 32a — 3-way protection against heat damage. Heat automatically shut off when: thermocouple fails; power to instrument is disrupted; tube burns out. Bulletin GEC-713. General Electric Co.

Regulators, Temperature 314 — Designed to limit heater steam pressures to an adjustable maximum—the need for a separate reducing valve is completely eliminated. Details in Bulletin T50. Spence Engrg. Co.

Spectrometers, Mass 140 — New acetylene production process uses continuous process-monitoring mass spectrometer . . . for "on the spot" control. Offers details in Bulletin CEC-1824-X18. Consolidated Engrg.

Spectrophotometers, Recording 313 — Used in examination of alkaloids, synthetics, drugs in human & animal body fluids, foreign constituents in drugs, heavy metals in plastics, etc. Data File 96-14. Beckman Div.

Thermocouples 32b — Special design for special application . . . assures superior performance for thermocouples & thermocouple wire. Valuable selection data in Bulletin GEC-714. General Electric Co.

Thermometers, Dial 494F — Details specifications & special features of various types of dial thermometers for industrial & laboratory use. Includes data on accessories. Rochester Manufacturing Co.

Thermometers, Electronic Resistance 99 — Resistance thermometer operation over a complete range from —300F to 1200F made possible by development of a low-cost platinum resistance element. Bulletin 230-C. Bailey Meter Co.

Transmitters, Pressure 494G — For measuring fluids with positive seal between receiver & fluid. Includes operating features & advantages, specifications, installations, etc. Catalog 4000. King Engrg.

Wells, Thermocouple 494H — New thermocouple protection tube combines thermal conductivity & shock resistance of metal with oxidation & deformation resistance of ceramics. Bulletin P1261. Bristol.

Construction Materials

Alloys, Hardfacing 371 — Superior resistance to corrosive agents, abrasion & galling. Spraywelding method of applications quick & economical. Hard-Facing Manual 77 & Data Sheet 3. Wall Colmonoy.

Blocks, Glass 494I — Offer numerous features: better daylighting; high insulation value; low surface condensation; privacy & protection; low maintenance costs; etc. Illustrated. Pittsburgh Corning.

Castings, Stainless Steel 424 — Production of castings maintained to rigid standards by consistent laboratory control. New up-to-date booklet describes characteristics and applications. Waukesha Foundry.

Coating Systems, Protective 230a — Numerous Ucilon coating systems have been developed to beat a wide variety of corrosives under various conditions. Detailed information in Bulletin MC-7. United Chromium.

Coatings, Protective 494J — Synthetic rubberized base coatings are highly resistant to acids, alkalis, and corrosive chemicals which normally cause deterioration of metal, concrete, wood, etc. Earl Paint.

Coatings, Protective 396 — Gives complete information on base formulation . . . adhesion . . . abrasion resistance . . . chemical characteristics . . . film thickness and cost. 8 p. Brochure No. 150. Cellcote Co.

Coatings, Protective 494K — Data on neoprene sprayed coatings & sheet linings. Outlines protective qualities in applications affected by sunlight, heat, abrasion, oil, cold, chemicals, etc. Metalweld.

Coatings, Protective 101 — Valuable guide helps effect substantial savings on maintenance costs. Discusses correct coating selection methods & covers surface preparation & application techniques. Amercoat Corp.

Coatings, Protective 494L — Makes available a new illustrated Bulletin which describes the uses and application of the first air-curing, liquid neoprene protective coating. Gates Engineering Co.

Coatings, Protective L412 — Includes information on an air-curing liquid neoprene coating that produces a thickness of at least 5 mils with 1 primer & 2 top coats. Pennsylvania Salt Manufacturing.

Coatings, Protective, Plastisol 230b — Toughness & chemical resistance often permit ordinary steel or cast iron to be used under extremely corrosive conditions in place of stainless. Bulletin VP-1. United Chromium.

Electric Furnace Shapes 20-1b — Covers electric furnace refractories—cores, tubes, muffles—of Alundum or Crystolon materials. Tells how to construct electrical furnaces for laboratory. Bulletin 458. Norton.

Fabrication, Metal 364 — Manufacturers metal products for many industrial uses . . . from complete carbon-black plants to steel conveyor boxes. Designs, engineers & fabricates to specific needs. Boardman Co.

Fabrication, Stainless Steel 394 — Features techniques of fabricating equipment with round corners for efficient service—round corners are stronger and easier to clean. Detailed Booklet. S. Blickman.

Insulation 494M — 40 p. illustrated Industrial Products Catalog with data on insulations, refractory products, asbestos-cement pipe, packings, gaskets, roofing, siding, flooring etc. Johns-Manville.

Insulation Pipe 494N — Points out cost-saving features & advantages of aluminum wrapped-at-the-factory cellular glass insulation. Details in new, illustrated Bulletin. Pittsburgh Corning Corp.

Linings, Tank 388 — Plating tanks lined with Saran rubber reduce operating expense by eliminating contamination, corrosion and current leakage. Offers descriptive Catalog. Saran Lined Pipe Co.

Paints, Aluminum 389 — Feature added protection, long life, greater hiding capacity, greater light reflectivity, etc. Covers data on usage in new Aluminum Painting Handbook. Metals Disintegrating.

Paints, Metallic Zinc 356b — Makes available a descriptive booklet containing pertinent information on MZP—metallic zinc paint—for structural steel and galvanized surfaces. American Zinc Institute.

Refractories 20-1c — No other refractory is so chemically stable at high temperatures under both oxidizing and reducing conditions. Includes complete data on properties. Bulletin 1409. Norton.

Refractories, Silicon Carbide 53 — Offer many features: tested crushing strength of over 10,000 psi at 2500F; safe to use up to 3000F; withstand abrasive/erosive wear-&-tear far better than metals; etc. Carborundum.

Selectors, Stainless Steel 187 — For fast, accurate selection of stainless steels. Data on physical or mechanical properties, resistance to corrosion or scaling, machinability characteristics, etc. Crucible Steel.

Sheets, Galvanized 356c — For industrial roofing & siding. Feature low initial, application, & per-year costs; rust protection of zinc; strength of steel; etc. Detailed booklet. American Zinc Institute.

Steels, Stainless 494O — Offers pertinent up-to-date information in 28 p. fully-illustrated fabrication manual, "Drawing, Forming, Spinning and Cutting of Armco Stainless Steels." Armco Steel.

Steels, Stainless 294 — Will reduce shutdown time & add to equipment life. Feature superior corrosion-resistance to sulphuric acids, plating & pickling solutions, mixed acids, etc. Carpenter Steel Co.

Steels, Stainless 10 — Reduce shutdown time & add to equipment life. Data on corrosion resistance, properties, performance results, application & fabrication, in descriptive bulletin. Carpenter Steel.

Steels, Stainless 495A	Story of stainless steels in the fiery applications, with suggested procedure for selection of right grade. Illustrated "Armco Stainless Steels for Heat Resistance." Armco Steel.
Titanium 104	Shows resistance to chloride solutions & retains useful strength up to 800-1000F. Other advantages & data on application & fabrication of titanium alloys. Rem-Cru Titanium.

Pipe, Fittings, Valves

Connectors, Duct 495B	Can be adapted to many industrial applications for handling of difficult fluids and air under critical conditions of temperature and pressure. Data Sheet No. 1102R. Rubber Teck.
Fittings 223a	Master Catalog describes the complete range of products . . . compressed asbestos sheet packings for all purposes, valves, cocks, level gages, synthetic & silicone rubbers. Klinger Corp.
Fittings, Forged Steel 247	Drop-forged for high strength & toughness—the right combination of properties to withstand pressure, heat, shock, vibration & erosion. Informative Bulletins. Watson-Stillman.
Fittings, Pipe L406	Information on superior corrosion-resistant pipe fittings . . . screwed, flanged, butt weld. Includes complete company product line in descriptive Catalog 653. Camco Products.
Fittings, Welding 289a	Precision-process manufacture begins with the billet, continues thru the making of the seamless steel tube, & extends thru to production of the finished fittings. Globe Steel Tubes.
Fittings, Welding 303	Quality stainless steel butt welding fittings in Schedule 5—10—40 & tube O. D. Sizes from ¼" thru 24" & 36". Complete information in Catalogs 748, 1051. Tri-Clover Machine.
Hose, Air 495C	Extremely flexible wire braid air hose built for mucker use. Natural rubber cover treated for resistance to abrasion and impact. Will not sun check. Bulletin H4003. Elmco Corp.
Hose, Flexible 323a	For air, water, other fluids & gases. Easier to handle because it is light, strong & flexible, has no pre-set twist, coils & uncoils easily. Bulletin 6879. Raybestos-Manhattan.
Hose, Metal, Flexible 320	Industrial Rex-Flex heavy wall stainless steel hose available in 4 types to meet every industrial need. Describes advantages and applications in Catalog 130-R. Flexonics Corp.
Nozzles, Spray BL403	48 p. industrial catalog offers complete data on thousands of standard and special nozzles for every type of spraying. Includes related equipment. Catalog 24. Spraying Systems.
Pipe & Fittings, Glass 248-9a	For full-scale production operations. Strengthened by end-tempering, & feature corrosion-resistance, non-contamination, transparency, etc. Catalogs EA-1, EA-3. Corning Glass Wks.
Pipe Installation, Glass 248-9b	Pipe is easy to install & low in installed cost compared with other corrosion-resistant materials. Available in 6 standard sizes from 1- to 6-inch I.D. inclusive. Corning Glass Wks.
Piping Layouts 430a	Planning a sulphate pulping process system. Includes an enlarged diagram of practical piping layout along with detailed description. Piping Layout 72. Jenkins Valves.
Tubing 17	Company has performed stress rupture tests and creep tests on a great number of tubing steels. Offers complete information in literature references TDC 102 & TDC 153. Babcock & Wilcox.
Tubing & Pipe, Stainless 239	Uniformly ductile, easily workable—the result: smooth, accurate coils. Wall thickness is uniform. So are diameter, concentricity, strength. Details in Booklet CEC-54. Republic Steel.
Tubing, Stainless & High Alloy 275	Includes information on pressure, sanitary, mechanical, heat-resistant, ornamental and other forms of stainless and high-alloy welding tubing, in new booklet. Trent Tube Co.
Valve Operators, Automatic 495D	Feature greater torque, thrust & stem capacity; easier de-clutching; easier handwheel operations; 2-piece stem nut design; etc. Illustrated Bulletin. Phila. Gear Works.
Valves 374	Extremely versatile Y valves in corrosion service throughout the chemical industry where tight shut-off is required. Full information in Bulletin V/7. Duriron Co.
Valves 277	Manufactured in brass & stainless steels to function at pressures from 350 to 2200 psi. Practical for vacuum service. Offers full information. Kerotest Manufacturing Co.
Valves, Air Check 495E	Offer many advantages: replace stop & safety valves; do not leak; long-lived; cut costs; eliminate "air hammer" & "tank ring"; quiet; etc. Bulletin 509-D. Pennsylvania Pump.
Valves, Ball 495F	Ball valves offer many features: full round flow; quick opening and closing; resist wear longer; stay leakproof; no maintenance; etc. Illustrated Folder. Rockwood Sprinkler.
Valves, Bronze 164	Bronze valves offer superior design, construction & operating features. All popular sizes in stock for prompt delivery. Details in Circulars 534, 582, 574. Lunkenheimer Co.
Valves, Gate 284	Made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 lbs. Complete data. Darling Valve & Mfg.
Valves, Gate 287	Offers data on sturdy, small forged steel gate valves. Super-hardened gate and seats assure tight closure, smooth operation and low maintenance. Catalog 10. Chapman Valve Mfg.
Valves, Line Blind 369a	Visible shut-off line blind valves offer many features: unsurpassed for positive action; easy operation; long-life service; lasting safety. Detailed Catalog. Hamer Oil Tool.
Valves, Mud 495ff	For all mudline services. Offer many features: easier to operate; faster opening or closing; no "sanding-up;" less down time & maintenance; etc. Detailed Catalog. Edward valves.
Valves, Nickel Iron 430b	Designed primarily for the chemical process industries & are recommended for low-cost control of moderately corrosive fluids. Complete details in Bulletin 118. Jenkins Valves.
Valves, Pressure Regulating 495G	Detailed information on pressure regulating & relief valves. Covers applications, operating pressure & temperature, construction, etc. 24 p. Catalog 207. Schade Valve Mfg.
Valves, Safety Relief 28	Incorporate design & construction features that assure dependable tightness under the severest discharge piping stresses. Offers full information. Manning, Maxwell & Moore.

Electrical Equipment

Ball Bearing Units 495H	Rubber mounted ball bearing units designed for reduction of noise & vibration. 6 shaft sizes are manufactured, ranging from ⅛ to 1-inch. Bulletin 1253. Stephens-Adamson Mfg.
Bearings, Motor 255	Facts on advantages of pre-lubricated bearing design, with cutaway view, cross-section diagram comparison chart, & statements by bearing manufacturers. Bulletin B-2201. Reliance Elec.
Conduit, Electrical Wiring 49	Protects against oil, grease, weather, water, dirt, chemicals, corrosive fumes, salt spray. Light, flexible & installs easily in cramped places. Descriptive booklets. American Brass.
Motor Control, Synchronous 171	Includes data on these 3 pertinent features: graduated squirrel-cage protection; precision angle switching; load angle field removal. Bulletin GEA-5873. General Electric Co.
Motors 359	Extra dependability of Electro Dynamic motors covered in new report, "Motor Showdown." Includes data on comparative results of motor performance tests. Electro Dynamic Div.
Motors 71-4a	Data on new Life-Line "A" motors. Covers new insulating materials, new stator core, new cooling methods, new precision manufacturing techniques. Booklet B-6154. Westinghouse.
Motors, Air 495I	Superior features of industrial air motors assure top performance on any job: high starting torque; no fire hazard; vibrationless; heavy-duty construction; etc. Illustrated. Elmco.
Motors, Cast Iron Frame 96	Used in presence of dust, dirt, moisture, corrosive vapors. Feature protected laminations, special varnish treated windings & a running shaft seal. Bulletin MU-132. Wagner Elec.
Motors, Gear 285	Gear motors from 1/8 to 15 hp, single, double and triple gear reduction. From 1/8 to 3/4 hp refers to Bulletin 4-1p21. From 1 to 15 hp refers to Bulletin 4-1p31. Century Electric.
Motors, Gear 71-4e	Features of gear unit & motor discussed. Gear ratios for single, double & triple reduction types given. Describes complete line. 15p. Booklet B-5645. Westinghouse.
Motors, Totally-Enclosed 163	For dirty or corrosive location or for outdoor operation in all kinds of weather. Available in ratings on frames larger than NEMA 505 up to 3000 hp. Bulletin 51B7149. Allis-Chalmers.
Motors, Varidrive L390	Attainment of thousands of speeds by simple dial control. 2 to 10,000 rpm. Increase output . . . quickly repay initial investment. Illustrated Bulletin. U. S. Electrical Motors.
Starters, Motor 93	Built in wide range of ratings for squirrel-cage, wound-rotor & synchronous motors . . . for full or reduced voltage . . . reversing or non-reversing. Bulletin 14B6410B. Allis-Chalmers.

Circle Key Numbers on Postcard for Catalogs and Bulletins.

Mechanical Equipment

Belts, V 77 — Adjustable v-belts easy to coupie & install . . . do a better job for a longer time. Full information on new v-belts in 8 p. illustrated Bulletin. Manheim Mfg. & Belting.

Casters & Wheels R462 — Provide maximum floor protection, economy & efficiency. Sturdy construction gives extra long life of satisfactory service. Types and sizes for every purpose. Darnell Corp.

Couplings, Flexible 496A — Engineered for dependability & long life. Simplified design reduces maintenance. Sizes & types for every service. Offers 20 p. illustrated Catalog. Lovejoy Flexible Coupling.

Fasteners, Stainless Steel BR397 — Stainless fasteners & pipe fittings in stock. All types & sizes of screws (hex head, Phillips, slotted, socket), bolts, nuts, rivets, etc. Manual P6. Allmetal Screw Proucts Co.

Packings BL408 — Provide better sealing longer runs, and less friction on rods, shafts, sleeves. Precision-made die-molded rings and ring sets available for requirements. File DMCE. Durametallic.

Packings, Lattice Braid 382 — Braided thru & thru for longer service, less maintenance. Covers advantages, applications, types of services, available materials, etc. in detailed Folder AD-131. Garlock Packing.

Packings, Teflon 354 — Valve and pump packings offer many features: all teflon; all low friction load; all-chemical resistant. Complete information in Bulletin TP-1053. United States Gasket Co.

Reducers, Speed 496B — 180 p. covers all models in entire line of worm gear speed reducers, with full engineering data —dimensions, weights, hp capacities. Catalog 400. Cleveland Worm & Gear.

Seals, Mechanical 106 — Ability of company line of mechanical seals to handle corrosive liquids proven by the thousands of successful installations. Offers details in Bulletin W-350-B16. Worthington.

Stuffing Boxes, Pump L399 — Data on common stuffing box difficulties. Number of rings, depth of box, type of packing . . . chemical & physical properties of fluid pumped, speed of shaft, etc. Bulletin S-147. Taber Pump.

Turbines, Mechanical Drive 220-1 — Turbines offer cost-saving features: combined trip-throttle valve; interchangeable parts; single reservoir for cooling lube oil; etc. Bulletin GEA -4955A. General Electric Co.

Turbines, Solid Wheel 309 — Rugged construction ad superior design of solid-wheel turbines result in savings by keeping maintenance costs to a minimum. Details in Bulletin S-116. Terry Steam Turbine.

Turbines, Steam 84 — Turbines range from 150 hp down to fractional in 6 frame sizes. Feature large number of manually operated valves for individual control of steam nozzels. Bulletin 135. Coppus Engrg.

Turbines, Steam 496C — Standardization, simplicity of design & interchangeability result in top efficiency & performance. Dimensions, hp selection curves, etc. in illustrated Catalog 500. Dean Hill Pump.

Heating & Cooling

Boilers, Automatic 496D — Feature two-pass design, guaranteed minimum efficiency of 80%, maximum radiant heat transfer from flame to water-cooled furnace walls, etc. Bulletin BE3. Boiler Engrg. & Supply.

Boilers, Packaged Automatic 14-5 — Packaged boiler units in a wide range of capacities from 15 to 500 horsepower, with complete interchangeability of fuels. Information in descriptive Bulletins. Orr & Sembower.

Conditioners, Air 392 — New more reliable air conditioning method with exact moisture control. Offer many features: flexible; compact; inexpensive to operate; etc. Bulletins 112 & 122. Niagara Blower.

Conditioners, Air, Pulpit 496E — For use in industrial control areas where heat, dirt, or fumes create hazardous working conditions. Mechanical features, capacities, dimensions in Bulletin 1307. Dravo Corp.

Coolers 385d — Fabricated of stock components to standardized details . . . available for wide range of oil & water cooling requirements. Full information in Bulletin 122. Whitlock Mfg.

Generators, Steam 496F — Describes & illustrates complete line of steam generating equipment. Includes generous use of sectional views with concise descriptions. 16 p. Bulletin SB-50. Erie City Iron Wks.

Heat Exchange Equipment 383 — Offers the advantages of fitting the equipment to specific needs—custom built from standard basic elements. Saves time, cost and design drudgery. Manning & Lewis Engrg. Co.

Heat Exchangers 496G — Describes operation of heat exchangers used in cooling or controlling of temperatures of industrial liquids. Diagrams & installation photos. Bulletin 120. Niagara Blower Co.

Heat Exchangers 496H — Diversified heat exchanger products grouped for ready reference into chemical, industrial, power plant & marine classifications. Illustrated, 16 p. Bulletin 1000. Davis Engrg.

Heat Transfer Equipment 496I — Tailored to meet individual performance specifications in heating or cooling of corrosive or non-corrosive liquids & gases. Details in Bulletin 600-2. Industrial Filter & Pump.

Heaters 385c — Straight tube, floating head (pull thru) type. Easy access to tube bundle—for simple maintenance. Applicable to heating of dirty, fouling liquids. Bulletin 250. Whitlock Mfg.

Heaters, Air L416 — Job performance efficient, economical, safe. Wide industrial use—drying, baking, curing, evaporating, digesting, sterilizing etc. Literature Group H53-12. Surface Combustion.

Heaters, Air 346 — Readily fitted to ovens, kilns, spray dryers, etc . . . an ideal source of heat where products of combustion may be mixed with the air. Information in Bulletin 104. Thermal Research.

Heaters, Electric 56 — Offer dependable, efficient, economical around-the-clock service in applications requiring continuous, accurately controlled temperatures. Data in Catalog 50. Edwin L. Wiegand.

Heaters, Oil 496J — Electric oil heaters . . . with easy, instant starting & automatic control . . . are convenient, efficient means of heating heavy fuel oils. Bulletin 709A. Hauck Mfg.

Heaters, Tubular, Calrod 496K — Covers many pipeline applications of tubular heaters in industry. Chart shows heat losses from vertical, solid, smooth surfaces of various metals. Bulletin GEA-5095A. Gen. Elec.

Heating Systems, Dowtherm 357 — Illustrated 28 p. includes useful engineering data, 136 different types and sizes to choose from, nine different complete system layouts, etc. Bulletin A-100. Eclipse Fuel Engrg.

Heating Units, Electric 496L — Methods of electrically heating liquids, air, gases, machine parts, process equipment in 32 p. illustrated booklet, "101 Ways to Apply Electric Heat." Edwin L. Wiegand Co.

Platecoils 414 — For tank heating & cooling problems due to inefficient pipe coils. Cost-saving Platecoils heat or cool 50% faster & take 50% less space in the tank. Bulletin P61. Tranter Mfg.

Reboilers 385a — For conventional evaporation service. Tube bundle positioned low in shell—minimizes shell size. Design considers heat flux, boiling rates, etc. Bulletin 130. Whitlock Mfg.

Traps, Steam 45 — Feature small, handy size, stainless steel body & working parts, quick installation, low initial cost, easy maintenance, etc. Steam Trap Selector offered. Yarnall-Waring Co.

Traps, Steam 496M — Inverted bucket traps known for trouble-free, longer life, since bucket is guided on patented center tube. Prevents damage to bucket, valve & seat. Bulletin 154. V. D. Anderson.

Handling & Packaging

Bag Closing Machines 330 — Better protection, faster packaging at lower cost. Close open-mouth, multiwall paper bags semi-automatically. Tape & sew 15 bags a minute. Complete data. International Paper Co.

Bag Closing Machines 496N — Emphasizing importance of speed & economy in closing small paper bags, brochure describes & illustrates equipment designed for these operations. Bulletin 100. Union Special Mach.

Belts, Conveyor 496O — 30 p. catalog covers industrial rubber conveyor belting. Includes full page photos of belting installations, technical data on belting constructions, etc. Hamilton Rubber Mfg.

Carriers, Pivoted Bucket 496P — Help solve tough materials handling problems. Many circuit layouts possible—handle fragile crystals, lump or powdered materials. Pivoted Bucket Bulletin CE-454. Hapman Conveyors.

Conveyors 387a — Covers conveyors—ranging from power & gravity conveyors, roller, belt, slat, chain, pushbar, sectional—to portable, self contained units—etc. General Catalog. Standard Conveyor.

Conveyors 162 — Feature the advantages of quick "pick-up" in solving materials handling problems. Offers full information on handling bulk materials pneumatically. Bulletin 529. Dracco Corp.

Conveyors 307	Offers information on conveying systems which feature fast, safe, clean handling of materials in small space at low cost per ton. Bulletin No. 140. Stephens-Adamson Mfg. Co.
Conveyors, Belt 497A	Company makes available an 80 p. "Redi-Fab" conveyor erection manuel which features hundreds of illustrations showing every phase of erection and operation. Barber-Greene Co.
Conveyors, Handibelt 387b	Convey horizontally or at any decline and incline angle within their range. Easy to wheel about or adjust—fit in crowded aisles, cars, etc. Bulletin 63-D. Standard Conveyor.
Conveyors, Screw 13	92 p. includes pre-engineered selection and application data. Screw conveyors offer efficient operation plus long-life, low maintenance service. Data Book 2289. Link-Belt Co.
Drive Units, Fork Truck 497B	Covers design, operation and maintenance of new clutchless fork truck drive units. Includes operational details and advantages in illustrated Brochure. Clark Equipment.
Drums 413	Steel drums assure complete product protection. They are scale-free & rust-inhibited. Capacities from 2½ to 110 gallons. Provides illustrated Brochure. U. S. Steel Products.
Feeders 497C	Scale feeders & meters offer accuracy, reliability, versatility for continuous weighing of free flowing solid materials. Application data in Pub. TA-1002-M. Wallace & Tiernan.
Feeders, Constant-Weight L397a	Data on a regulating feeder which maintains a positive constant-weight feed rate regardless of feed size or volumetric variation. Illustrated Bulletin 33-D-11. Hardinge.
Feeders, Vibrating 46	Feature higher output, easier control, lower power needs, smaller space needs, safer operation, less vibration, etc. Complete details in Data Sheet 5302. Richardson Scale Co.
Feeders, Volumetric 423	Volumetric feeders of simple design and rugged construction, easily adapted to installations requiring proportional pacing by auxiliary meters. Bulletin 45-H8. Omega Mach. Co.
Gluers & Sealers 429	Greatly increase number of cases that can be prepared for shipment within a given period. Wide choice of models to meet exact requirements. Descriptive catalogs. Standard-Knapp.
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Materials Handling 497D	Graphically describes the Benchevator, a new materials handling device that speeds work on anything handled in stacks or sheets, in Bulletin 14. Rodney Hunt Machine Co.
Materials Handling 497E	Shows how new & revolutionary units are used to work-position, dump, store, collect & transfer variety of materials & scrap. Details in illustrated Booklet MH-811. Union Metal Mfg.
Scrapers, Folding 497F	Data on heavy-duty high capacity scrapers. Folding feature makes scraper require less power on return pull & dig in for full load on every trip. Bulletin C3004. Eimco Corp.
Storage Vessels, Water 497G	Describes and illustrates all types of water storage vessels and several installations of purification and filtration plants. Detailed 20 p. Catalog H20. Hammond Iron Wks.
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Trucks, Fork 497J	Offers illustrated 16 p. bulletin depicting advantages of palletized handling. Includes specifications and dimensional drawings on the eight Palletier models. Barrett-Cravens.
Trucks, Pallet 497K	Designed to perform with ease for both light as well as heavy loads. Lift of 5" is accomplished with smooth functioning, fast acting hydraulic pump. Illustrated. Paliton.
Tube Systems, Pneumatic 387e	Provide swift, sure, safe transportation of messages, documents, blueprints, samples, small parts, money, etc. Complete information in Bulletin SPT11. Standard Conveyor.

Processes, Services, Misc.

Ammonia Process 497L	Yield and cost advantages, principal operating features, and economics of a unique process design for ammonia plants are outlined in 8 p. illustrated booklet. M. W. Kellogg.
Autopositive Paper 497M	Makes available illustrated booklet, "Modern Drawing and Document Reproduction," offering information on the extraordinary line of Kodagraph materials. Eastman Kodak Co.
Cathodic Protection 356a	Provides valuable data on zinc for cathodic protection and grounding electrodes, in informative booklet "Cathodic Protection with Zinc Anodes." American Zinc Institute.
Cathodic Protection 497N	Flange insulation for cathodic protection . . . stops flow of stray and galvanic currents. Covers data on packaging, specifications, etc. Illustrated. F. H. Maloney.
Cathodic Protection 497O	1954 illustrated 52 p. catalog and price list covers over 700 individual items used by the corrosion engineer. Includes useful technical data. Catalog 54. Cathodic Protection Service.
Design & Construction 497P	Pioneer in the design, engineering, and construction of complete plants and equipment for the resin, plastics, and associated industries. Data in Bulletin 2449. Blaw-Knox.
Filter Aids 497Q	Chemically inert, sterilized in processing & suitable for filtering all types of liquids from acids to zein. Used in processing many products. Bulletin B-12. Dicalite Div.
Filter Aids 497R	Data on use of a specially treated diatomite filter aid for removing emulsified oil from condensate or process water . . . simply . . . dependably . . . economically. Johns-Manville.
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Fire Protection Systems 497S	Valuable information on economical, efficient, automatic fire protection systems which safeguard property, prevent loss of life, etc. Illustrated Bulletin 2426. Blaw-Knox.
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Laboratory Ware 20-1e	Offers many properties important to development, experimental or analytical work. Chemically stable, stands temperatures to 1900° C., and easy to clean. Bulletin 793. Norton.
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Nameplates, Decal 497V	Shows hundreds of uses for durable, washable decal nameplates . . . as trademarks, instruction charts or diagrams—in any size, colors or design. Nameplate Manual. Meyercord Co.
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Petro-Basic Production 7	Petro-basic production . . . continuous & dependable. Simplify purchasing . . . keep inventories at a minimum without upsetting your processing timetables. Celanese Corporation of America.
Porous Mediums 20-1d	Typical applications: filtering water or solvents; cutting oils, wine & other liquids; reclaiming cleaning fluids; handling industrial oil wastes; etc. Bulletin 140. Norton.
Research Services 497X	Covers Foundation's expanded literature research services available to industry. Offer technical, patent, & economic surveys of all magnitudes. Armour Research Foundation.
Sampling, Automatic 497Y	Company makes available article which includes graphic description of how a simple water spray prevents the buildup of solids on automatic sample cutters. Denver Equipment Co.
Sprinklers, Spray, Automatic 497Z	Extinguish more fire with less water, permit wider spacing of sprinklers, and—fewer heads means lower installation cost. Bulletin 70. Automatic Sprinkler Corp. of America.
Telephone Systems, Business 497AA	Describes how executives and key employees can be quickly reached anywhere in the plant or office by means of a special signaling device. Illustrated brochure. Automatic Electric.
Urea Process 497BB	"Ammonia-saturated" process for producing urea offers reduced operating costs & initial investment, higher yields, high on-stream efficiency, high product purity. M. W. Kellogg.

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Flashback . . .

To make sure that you don't miss any news that could help you with your job, Chemical Engineering is doing a double take for you. The listing on this page is a repeat of the editorial listings only on chemicals, equipment and services featured last month in the New Equipment and New Products departments. Use the postcard for more information on any item in this list.

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11d	43a	65	93	135b	166	253b	276B	297-8c	319b	348c	374	400	R420	BL444	490J	491J	492E	494L	497H
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20-1b	46	71-4d	102	149	205	263	278D	302a	323d	355b	383	BL403	TR428	450	490R	491R	492M	495E	497P
20-1c	47	71-4e	103a	150A	207	264A	278E	302b	323e	355c	384	R403	BR428a	451	4908	4918	492N	495F	497Q
20-1d	48	75	103b	151	209a	264B	279	302c	323f	355d	385a	404a	BR428b	452	490T	491T	4920	495H	497R
20-1e	49	76a	104	152A	209b	265	280A	302d	323g	355e	385b	404b	BR428c	455	490U	491U	492P	495G	4978
20-1f	50	76b	105a	154A	212-3a	266A	280B	303	324a	356a	385c	405	BR428d	457	490V	491V	492Q	495H	497T
22-3a	51	76c	105b	154B	212-3b	266B	280C	304	324b	356b	385d	aL406	429	460	490W	491W	492R	4951	497U
22-3b	53	76d	105c	154C	215	266C	280D	305a	324c	356c	386	L406b	430a	TL462a	490X	491X	493A	496A	497V
24-5a	54	76e	106	154D	217	266D	280E	305b	324d	357	387a	TR406	430b	TL462b	490Y	491Y	493B	496B	497W
24-5b	55	77	109	156A	219	267	281	306a	328	358	387b	BR406	431	TL462c	490Z	491Z	493C	496C	497X
24-5c	56	78	110-1a	156B	220-1	268A	283a	306b	329	359	387c	407a	432	TL462d	490AA	491AA	493D	496D	497Y
26-7	57a	79	110-1b	157	223a	268B	283b	306c	330	360	388	407b	433	TL462e	490BB	491BB	493E	496E	497Z
28	57b	80	110-1c	158A	223b	268C	284	306d	331	361	389	TL408	TL434	BL462	490CC	491CC	493F	496F	497AA
29	57c	81	110-1d	158B	223c	268D	286	306e	336	362a	L399	BL408	R434a	R462	490DD	491DD	493G	496G	497BB
30-1	57d	82-3	113	159	223d	268E	287	306f	337	362b	M390	R408	R434b	479	490EE	491EE	493H	496H	497CC
32a	57e	84	115	160A	225	269	288	306g	338	362c	391	409	R434c	480	490FF	491FF	493I	496I	501
32b	57f	85a	119	160B	227	270A	289a	307	340	362d	392	410-1	435	481	490GG	491GG	493J	496J	502
33	57g	85b	121	160C	230a	270B	289b	308	341	362e	393	L412							

. . . And these items in the Reader Service "Flashback" Section (p. 498)

148A	152B	156B	158B	160B	160F	272A	274C	276B	276F	278D	280B	282B	282E	284C	284F	286B	286E	288B	288E
150A	152C	156C	158C	160C	160G	272B	274D	276C	278A	278E	280C	282C	284A	284D	284G	286C	286F	288C	288F
150B	154A	156D	158D	160D	160H	274A	274E	276D	278B	278F	280D	282D	284B	284E	286A	286D	288A	288D	288G
152A	156A	158A	160A	160E	270A	274B	276A	276E	278C	280A	282A								

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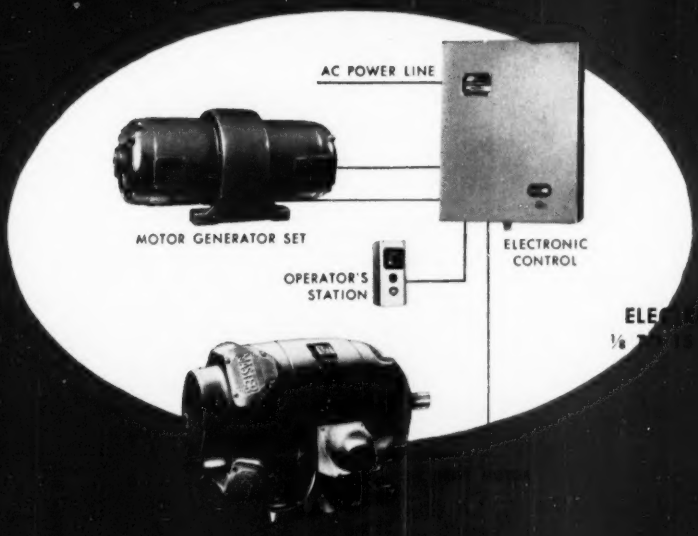

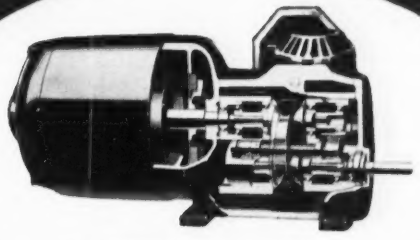

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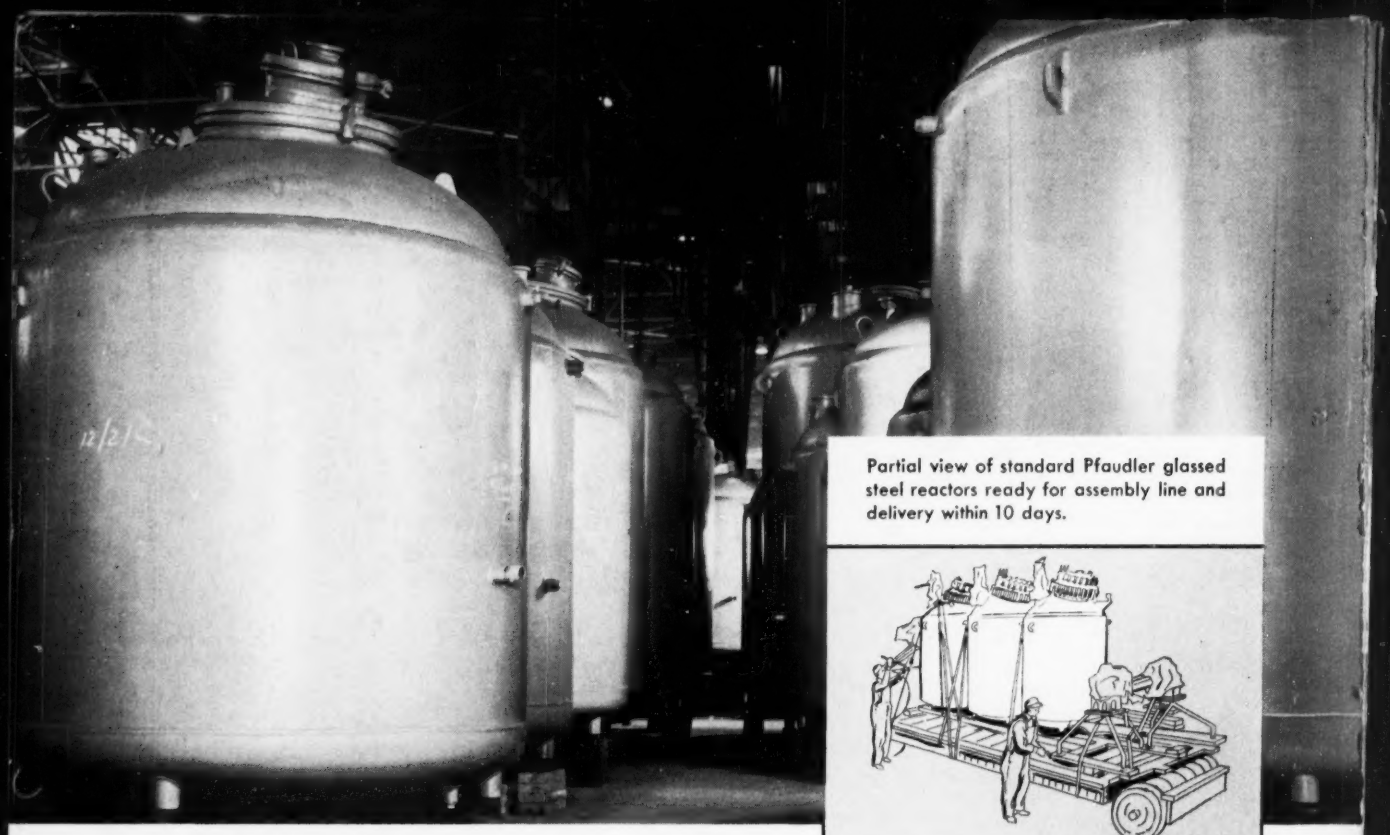

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